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The Outlook

Headaches Ahead

SOME idea of just how far we have to go before several of the visions of the more optimistically minded can become operational realities was afforded by the full-day debate of the Royal Aeronautical Society last Thursday. Of the four separate Papers read, three dealt with aircraft problems and one with power-plant installations, and they tended to stress the difficulties rather than the achievements, as they were intended to do under the title of the meeting, which was "Discussion on Engineering Problems of Future Aircraft."

Two of the three Papers on aircraft were largely concerned with problems arising from size, while the third dealt with the tailless, notably sweep-back and its troubles. Mr. A. E. Russell, Bristol's chief aircraft designer, had much to say on size problems. His work on the Brabazon I enabled him to speak from first-hand knowledge, not to say feelingly, of the extra difficulties introduced by increased size, and after listening to him one cannot be surprised that it takes so long to produce a large prototype. The long jump from the largest previous size necessitates much research and experimentation, in addition to manufacturing and assembly difficulties due to size of components.

Perhaps the outstanding impression left after listening to Mr. C. P. T. Lipscomb's Paper on flying boats was the need for keeping the number of parts down to a minimum. He quoted the case of the American Seabee amphibian (described in our issue of September 5th, 1946) in which a complete re-design for production was necessary, which resulted in an immense saving in production costs. As chief designer at Shorts, and with the construction of the huge Shetland flying boats for recent practical experience, Mr. Lipscomb shared with Mr. Russell the belief that power-operated flying controls are a better solution than aerodynamic balancing for large aircraft. It was interesting to find, however, that whereas Mr. Lipscomb favoured the "cottage loaf" or "figure eight" cross section of hull, Mr. Russell preferred the single-deck circular section for long-range aircraft carrying a relatively small payload in the form of passengers. They agree that the circular section is efficient structurally, but a somewhat uneconomical shape into which to fit passengers.

It was, perhaps, significant that Mr. Lipscomb's Paper on flying boats was much shorter and, on the whole, disclosed fewer problems than Mr. Russell's on large landplanes. The fact that its support is distributed over a large area, whereas that of the landplane has to be concentrated at two or three points from a wheel undercarriage, must help to reduce some of the problems.

A further reason for the brevity of the paper may have been that Mr. Lipscomb confined himself largely to stressing the importance of close co-operation from the beginning of a design between the design office and the production department.

Mr. G. H. Lee, who outlined some of the difficulties with the tailless type of aircraft, has had much experience in this field, as he is in charge of the Handley Page research section, among whose studies has been this unorthodox type. Actually, Mr. Lee's Paper dealt with sweep-back rather than with the tailless. As he said, his examination "applied generally to swept-back wings, whether they have a tail behind them or not."

From the aerodynamic point of view, the great trouble with the swept-back wing appears to be tip stalling, encouraged by the rather violent outflow from the ends of part-span flaps. But also from the structural point of view does the swept-back wing introduce problems. For instance, spar-bending in a straight wing does not (or at any rate need not) produce a change of incidence. In a heavily swept-back wing the pull-out from a dive will increase the load, cause the spar to deflect, and the

tip incidence will be reduced. A great deal of work can be seen to be necessary before aerodynamic and aero-elastic problems can be said to have been solved.

Power Plants

THE task of dealing with power-plant installations in the R.Ae.S. all-day debate fell to Mr. F. M. Owner, who guides the Bristol Aeroplane Company's turbine development. His Paper covered an extremely wide field, including an estimate of the types of aircraft likely to be needed during the next five to ten years.

It is extremely difficult to select any particular conclusion from his Paper as being the outstanding one, but perhaps it may be said that he foresaw the retention of the piston engine for a considerable time to come for certain classes of aircraft; that he was optimistic of the future of the turbine-airscrew combination; and that he did not appear to be very enthusiastic about the turbine-jet, perhaps because in his forecast of likely aircraft types of the period covered by the Paper he rather questioned whether the limit of fighter development has not been almost reached because of the limitations of the endurance of the human body.

Paris—Unchanged

WHETHER it is hospitable Paris itself, or the memory of the many intriguing and excellently presented aviation exhibitions of past years, that constitutes the great attraction it would be hard to say; the fact remains, however, that the term International applies, and nearly always has applied, more aptly to the great crowds who visit the Grand Palais than to the manufacturing companies represented at the Expositions Internationale de l'Aeronautique.

In this XVIIth Salon—a shop window for world aviation—Britain undoubtedly takes the leading position, and this indicates her determination to hold with her exports such a place in the world's aircraft markets.

France, some of whose problems of post-war reconstruction are similar to our own and many more acute, has made a remarkable recovery. This becomes apparent in tangible form from the aircraft, mock-ups and models exhibited, but in that a large proportion of these have not reached a sufficiently advanced stage to judge their real value, the more significant indication of recovery of the French aircraft industry is in the vigorous and enthusiastic spirit underlying these exhibits and the French section of the show generally. While many designs may be quickly forgotten, the fact should not be overlooked that the French have some very promising designs in almost every class.

At the present time it is true that every country with the exception of Britain is handicapped by the lack of suitable power units for its latest aircraft. In this country the converse is partially true, although the months still needed to perfect several important gas turbines may enable airframe deficiencies to be remedied.

The significance of last Monday's flight to Paris of the Nene Lancastrian with its load of distinguished passengers must not be missed. It *is* the first jet transport.

The Paris Exhibition is costing this country a great deal of money; the wisdom of showing two aircraft of the same type among the small total of military aircraft is certainly open to question. The Show as a whole is, however, a great credit to this country in particular, to the others taking part, and to its organizers.

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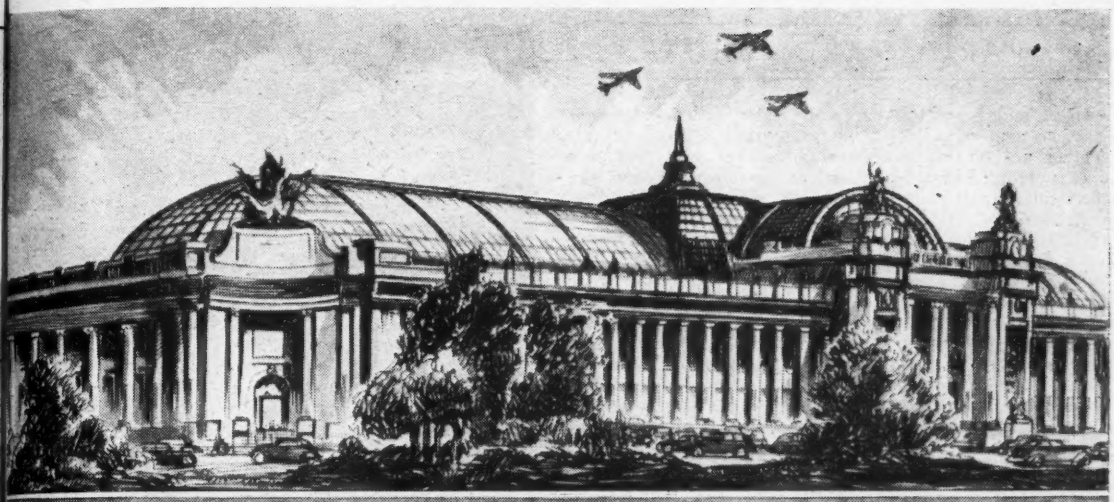
IN THE GRAND PALAIS: A general view of the exhibits in the seventeenth *Salon de l'Aeronautique* now being held in Paris for the first time since 1938. Despite supply difficulties, the Salon is presented with all the slickness and artistry so typical of the French.



PARIS AERO SHOW

Britain to the Fore : Renaissance of France's Aircraft Industry : Helicopters and Light Machines Prominent

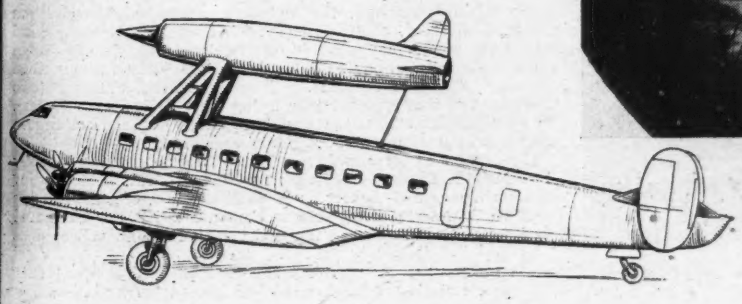
Illustrated by Flight Photographs and Sketches

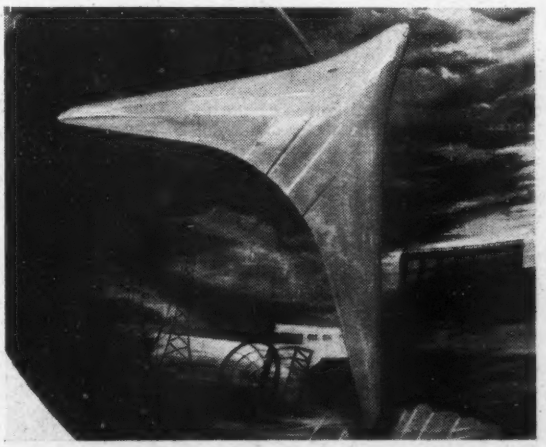
BEFORE the opening of the XVIIth International Salon d'Aviation last Friday, almost everyone in the British (and probably in the French) aircraft industry seemed prepared to forecast what it would be like. We were told that it was to be about one-third British, and that the majority of the French firms had not had sufficient time to produce more than mock-ups and models; it was hinted, nevertheless, that, characteristically, the French might "pull something out of the bag." The truth is that those who have attended many of the pre-war expositions find the same atmosphere, the same relative standard, and the same advanced French projects. However, as a whole the display is less representative of world aviation.

America, which has become increasingly important during the war years, is very sparsely represented by two or three manufacturers, and some airline companies. Germany, except in its obvious influence on the design of some aircraft is, of course, missing; so is the U.S.S.R. Italy, through the Fiat company, and Holland, through Fokkers, have only one stand each, while Czechoslovakia groups its engines and aircraft on two stands. Sweden shows two engines. Thus the French firms predominate.

An important difference in the British section is the support given by the Ministry of Supply, Royal Air Force and Royal Navy. In addition, among the individual companies, the Hawker-Siddeley Group and the manufacturers of accessories are truly showing the flag at Paris. In their own sphere we understand that the untiring and undiscriminating efforts of the two drivers of the R.A.F. mobile cranes during the days preceding the opening were nothing short of a major factor in permitting the completion of stands in time.

It is a pity that the American aircraft industry could not be better represented on this International occasion, for at present it is only from Britain, America and France that the student of design may expect to learn what is new in airframes and engines.





Above, the model on the Ministry of Supply stand of a future transport with a span of 250ft and a gross weight of 400,000 lb. On the left, the Rene-Leduc 010 on the back of the Languedoc, a ram-jet project which was widely discussed at the Salon.

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In an endeavour to sum-up the Salon in a few lines, it may be said with justifiable pride that British aircraft engines are far in advance of all others, and that, not unexpectedly, our military aircraft are also superior. In the light aircraft classes the French show great enterprise and ingenuity, and many interesting private-owner types are shown. The Miles Gemini, however, adequately upholds British prestige in its class. As in the automobile industry, the French firms which have contrived to keep going are handicapped by lack of official support and the short supplies of controlled materials.

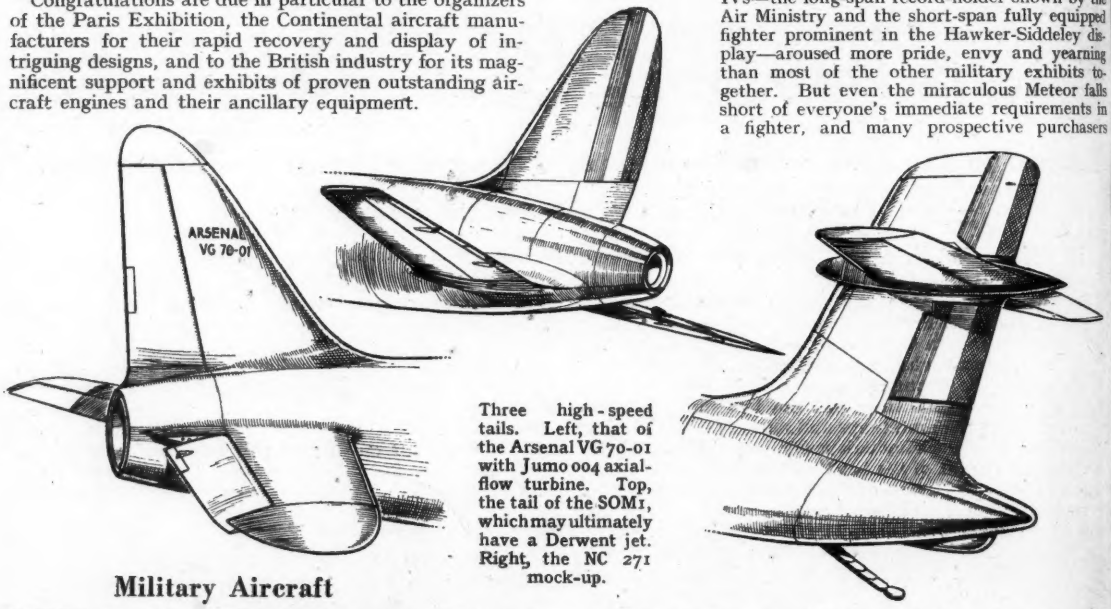
At least three different arrangement for twin-rotor helicopters appear on French stands, and in these designs, of which full-scale examples are shown, it would seem that France, like America, has established at least a temporary lead over this country. When more details of the Fairey Gyrodyne and certain other British designs are released it may be possible to modify this impression.

Congratulations are due in particular to the organizers of the Paris Exhibition, the Continental aircraft manufacturers for their rapid recovery and display of intriguing designs, and to the British industry for its magnificent support and exhibits of proven outstanding aircraft engines and their ancillary equipment.

Model of the Fokker F.26 17-passenger transport (two Nene). The cabin is to be pressurized.

hardly possible to draw conclusions on anything like a global basis, for America is showing little, and Russia nothing. But the Salon does help to focus interest on some new lines of military aircraft development.

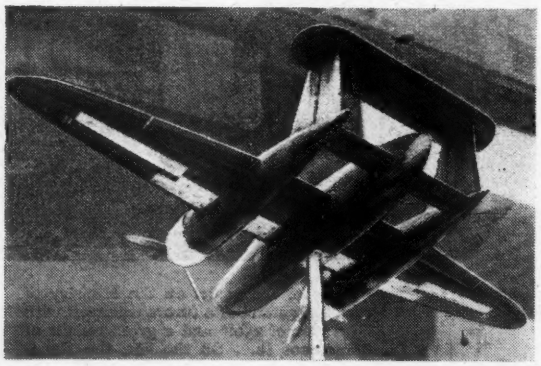
Among the fighters the two Gloster Meteor IVs—the long-span record-holder shown by the Air Ministry and the short-span fully equipped fighter prominent in the Hawker-Siddeley display—aroused more pride, envy and yearning than most of the other military exhibits together. But even the miraculous Meteor falls short of everyone's immediate requirements in a fighter, and many prospective purchasers



Three high-speed tails. Left, that of the Arsenal VG 70-01 with Jumo 004 axial-flow turbine. Top, the tail of the SOM1, which may ultimately have a Derwent jet. Right, the NC 271 mock-up.

Military Aircraft

THERE is a long-established tradition (and, whatever its true value in this unpredictable age, it is at least an engrossing and instructive pastime) of trying to detect "trends" among the muster of tangible and illusory material which always characterizes a Paris Salon. This year it is



A model of the N.C.1070, which is intended for dive-bombing and anti-submarine attack.

would doubtless have preferred a single Hawker Sea Fury X or Fairey Firefly IV to the pair of Gloster jets, though possessing no aircraft carrier from which to operate them.

Many visitors who have not been privileged to study the latest amendment sheet to the Meteor handbook, have been wondering how the reduced span affects all-round performance. The answer is that, despite the reduction in aspect ratio from 4.95 to 3.9, the top speed at sea level has decreased by only 5 m.p.h. and rate of climb has dropped by no more than 100-300 ft/min, according to height. The range is only 20-30 miles shorter, and the landing speed is now 125 m.p.h.

Britain's Jet Lead

Surprisingly enough, the Meteors are the only jet-powered fighters on show, though the French have three experimental machines which may provide some clues to the future design of trans- and super-sonic *avions de chasse*. These are described under "Research Aircraft." Models of the Vampire (two machines of this type are now flying with Rolls-Royce Nenes), the Supermarine E.10/44 and Saro S.R./A.1 are coming in for their due share of admiration and study.

French naval personnel are attracted by the glinting Hawker Sea Fury X displayed with a wing folded. This deck-landing Centaurus-engined fighter is a particularly workmanlike job and its wonderful compactness contrasts with the elongated tandem-engined Arsenal V.B.10 C.1 with Hispano 12Z engines and co-axial airscrews, the only other airscrew-driven fighter shown full scale. The Arsenal is nevertheless attracting plenty of interest and is claimed on test to have attained 435 m.p.h.

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at 23,000ft. Armament, of course, is wing-mounted, and comprises four 20-mm cannon with 600 rounds, and six machine guns with 2,400 rounds. The span and flying weight are 52ft and 19,150lb One understands that the V.B.10 C.1 is now regarded as a flying test-bed for the Arsenal double engines.

Despite the resourcefulness of its design, the V.B.10 is quite outclassed by the D.H. Hornet, shown as a model. Other British fighters appearing in miniature are the Supermarine Spiteful and Spitfire. On the Fiat stand is a model of the G.218 single-seater, of typical Italian radial-engined design.

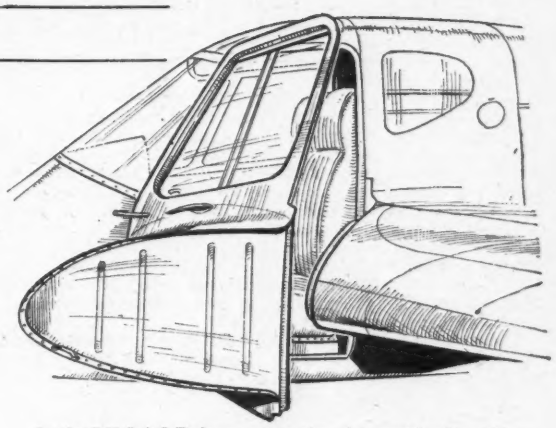
The Fairey Firefly IV is a standard production aircraft, though it bears no Service markings, and is shown without the now-familiar radar nacelle or the 50-gallon auxiliary tank. These appendages intrigued a number of onlookers before the Show opened; they decrease the top speed by about 16 m.p.h., but greatly broaden the Firefly's field of usefulness.

Naval Aircraft

Short Bros. have a model of the Sturgeon, which makes an interesting comparison with the French Navy's Nord 1500, a 23,750lb twin-engine deck-landing multi-purpose machine with S.N.E.C.M.A. 14R radials. Basically of Boston layout, the *Noreclair*, as it is known, has folding wings (gulled on the fixed inner sections) a bomb/torpedo bay divided longitudinally, a novel arrester-hook stowage (see sketch) and an interesting enclosure over the observer's cockpit. Eventually a S.A.M.M. tail turret with twin 20-mm guns will be fitted.

It will be instructive to follow the development of this class of aircraft relative to that of single-seat single-engined "strike" machines like our own Firebrand, the evolution of which is illustrated by a fine series of Blackburn photographs.

The French Navy is also interested in the N.C.1070, a wind-tunnel model of which is on view. This is quite unorthodox in having not only twin tail booms but a biplane tail,



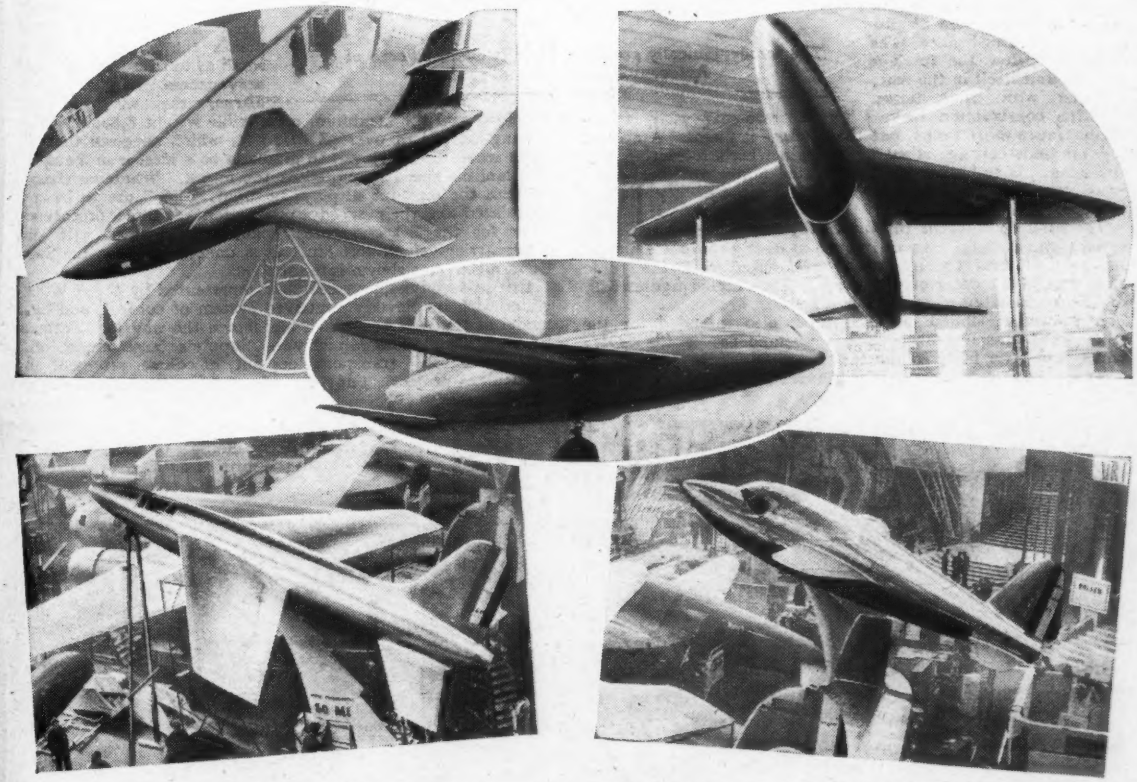
In the S.N.C.A.S.E. four-seater, the wing root leading edge forms part of the doors to facilitate entry.

and is intended for dive-bombing, torpedo attacks and anti-submarine work. Two 14R engines are probably proposed for the prototype.

For the present the standard French torpedo aircraft is the modified M.B.175, for which a neat dive-brake has been evolved. The brake flaps are on, and when operated, at right angles to, the trailing edge.

Miscellaneous French military machines shown as models include the Nord 1400 *Noroit* flying boat with two 14R engines. It follows in layout the Martin Mariner and has a gross weight of 35,900lb. The makers intend to develop it as an amphibian. Breguet are working on a larger four-engined boat, the Type 731, which has a clear-view cockpit in the extreme bow. This type they term *hydravion de croisiere*.

Both Gt. Britain and France present a recent type of mili-



Five French jet-propelled types. Top left, the NC 271 mock-up. Top right, the VG 70-01 with Jumo 004 jet. Centre, model of the SE 2400, the fuselage of which will house two R.-R. Nenes, mounted one above the other. Bottom left, the SOM1, which will be tested first as a glider. Bottom right the SO 6000, which is said to have been airborne for eight minutes.

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tary trainer. Britain's offering—the three-seater Percival Prentice, as ordered in quantity for the R.A.F.—represents a new instructional formula, while the French machine—the Morane MS472 P-2—is a more conventional-looking tandem-seater of greater power and equipped for training in flying technique, navigation, bombing, R/P firing and gunnery. The MS472 bears a certain resemblance to the MS406 fighter of the early war days, but has an even more remarkable undercarriage arrangement; the two main wheels retract into the fuselage, where they are stowed vertically side by side. The little Morane should be less expensive to operate than the Spitfire and Firefly Trainers, but with its lower power is inevitably handicapped.

There is some disappointment, at the time of writing, that no model has arrived of the projected SO 4000 Nene-engined jet bomber reputed to carry about 10,000lb of bombs for 1,850 miles. However, models have appeared of the NC 271 and SE 2400, both of which have been mentioned as prototypes of high-speed jet-propelled bombers and which are described later.

Research Aircraft

IN common with other countries, France proposes to make a profound study of transonic flight. To this end various manufacturers are building some sleek Germanic-looking machines with turbo-jet propulsion.

The prettiest of these on show (and, it is understood, the most nearly completed) is the VG 70-01, designed by M. Galtier. Surfaces are sharply swept back and have elliptical tips. The wing has pillar-box slots, and the tailplane is mounted low. A Jumo 004 axial-flow turbine-jet has been installed because this is the only unit of its class at present available in France. The intake is below the fuselage and the unit itself in the rear, together with three tanks. Wooden construction is used for the two-spar wing, which houses seven more tanks, but the fuselage is metal. A normal tricycle undercarriage is used, the main wheels retracting into the wing. Dive-brakes are to be fitted above and below the wing to slow the machine should compressibility danger threaten.

The all-up weight of this unusually interesting machine is to be about 6,000lb. An endurance of over 30 minutes should be attained, and the maximum level speed with the Jumo should be of the order of 560 m.p.h. Much higher figures will, of course, be attained in shallow dives.

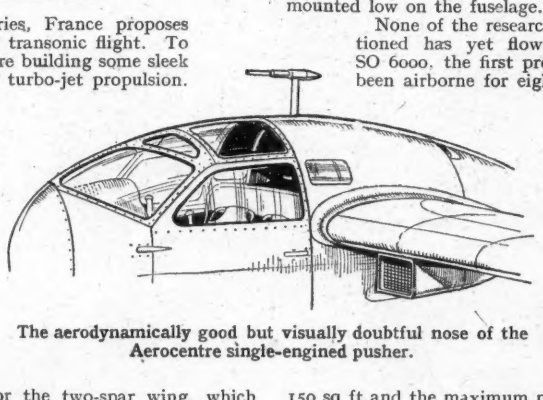
A somewhat similar research type, also intended for the study of high-speed aerodynamic phenomena, is the SOM1 which has been built in the S.N.C.A.S.O. works and should soon fly as a glider after an air launch. For this purpose a skid undercarriage will be fitted, but eventually, when a turbine jet (possibly a Derwent) is installed for powered flight, a tricycle will be substituted. Jet intakes will be of "elephant ear" design, positioned behind the wing.

On the machine exhibited there is a transparent panel flush with the top of the fuselage, but a drawing shows the pilot's cockpit in the nose. Horizontal surfaces are swept-back and square-cut, but the fin and rudder are rounded. The tailplane is attached very low on the fuselage. The following data are interesting: span, 29ft 3in; length, 29ft 6in; gross wing area 186 sq ft. According to version and conditions of test, all-up weight will vary between 6,170lb and 10,360lb.

Whereas the VG 70 and the SOM1 are more or less genuine airframes, the NC 271 is patently a wooden mock-up. This is shown on the Aerocentre (S.N.C.A.C.) stand and is spoken of as the prototype of a twin-jet bomber. German influence is again apparent in the design of the swept-back surfaces. The jet units are mounted in long fairings at the wing roots and the tailplane is high on the raked fin, with a "bullet" fairing *à la* Meteor.

The S.A.S.E. organization have managed to show a model of the SE 2400, mentioned as a possible jet bomber. In relation to the area of its swept-back thin wings, this has a very large fuselage to house two Rolls-Royce Nenes, mounted one above the other. It is understood that the intake will be on top of the fuselage, and the effluxes are in the extreme tail. The vertical surfaces are not swept back and the tailplane is mounted low on the fuselage.

None of the research and experimental aircraft mentioned has yet flown, which adds interest to the SO 6000, the first prototype of which is said to have been airborne for eight minutes. This type has been designed as a trainer for the pilots of jet-propelled fighters and as a flying test bed for the Jumo 004, Rateau A.65, Rolls-Royce Nene or Rolls-Royce Derwent turbine-jet units. The pilot and observer or pupil sit side by side (pilot to port) aft of the "shark's mouth" jet intake.



The aerodynamically good but visually doubtful nose of the Aerocentre single-engined pusher.

This results in a comparatively large fuselage, which makes the wings appear so small as to cause a pupil some nervousness. In fact, one learns, the wing area is 150 sq ft and the maximum permissible weight 8,800lb, giving a wing-loading of over 58 lb/sq ft, which suggests that the pupil would be overjoyed to graduate to a Meteor or Vampire. The landing speed is quoted as 100 m.p.h. Whatever characteristics the machine displays in flight, "SO" are to be congratulated on their speedy production of three prototypes. Data for the SO 6000 are: span, 30ft; length, 34ft 5in; undercarriage track 16ft 8in. It is understood that the Swiss Government has shown interest.

British aerodynamic research is represented by the A.W.52G glider with its cleverly contrived system of control, and by a model of the D.H.108 which has shown the way for Continental designers. The Ministry of Supply's large model of a "flying flatfish" transport does not, of course, represent any particular project, but the plan form, suggestive of a

The SO 7010 *Pegase* carries six passengers. The stress-bearing member of the fuselage is in the form of a "keel."

The SO 90 is an eight-passenger transport with two Béarn engines. It has an all-up weight of 10,070 lb.

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boomerang, and the formation of the flat jet outlets over the trailing-edge were noted and discussed. Miles Aircraft show a particularly pretty model of the supersonic M.52, into the design of which they put so much effort before its construction was abandoned.

Foreign Light and Medium Civil Types

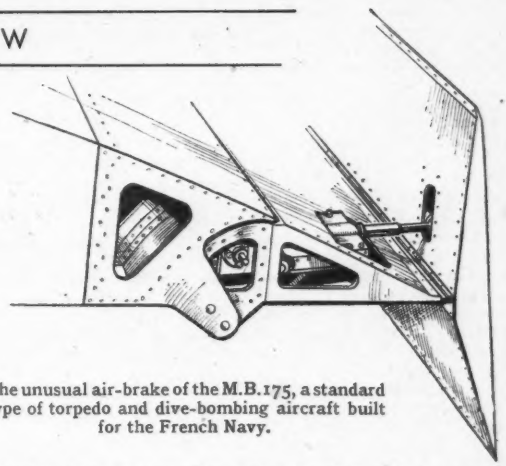
THE initial reaction to a quick overall glance at the foreign light contingent in the Salon is one of appreciation for the apparent rapidity with which our Continental friends have reoriented themselves. It is only on closer inspection that the facile quality of most of the exhibits becomes clear. This is not to decry the effort made—such would be both blind and ungenerous—but, on the whole, the practicability of many of the models, and ideas, displayed is not very great.

In the field of light aircraft—private owner or taxi types—it is at once noticeable that in nearly every case tricycle undercarriages are employed, either nicely faired or retracting, but on the debit side it is equally noticeable that considerations of appearance and, perhaps, of aerodynamic cleanliness, have prompted the use of compound-curved front screens, usually set much too far in front of the pilot's eyes. General all-round view is really excellent in nearly every case, and all the cabins are thus given a light airy spaciousness ; but pity the poor pilot flying in dirty weather—this apart from the optical distortion to vision occasioned by many of the cunningly curved screens.

Two Good Northerners

On the S.N.C.A.N. stand are shown two very useful-looking machines, the Nord 1101 *Noralpha* 4/5 seat low-wing tricycle, and the slightly smaller Nord 1203 *Norécrin* three-seater on very similar lines. Both of these machines have side-by-side seating and dual control, and each is fitted with doors on both sides, which curve over to meet at the roof centre line and, as they are hinged on the leading edge, the cabins are rendered extremely accessible. Construction is all metal, except control surfaces, and the larger of the two, the *Noralpha*, is powered with a six-cylinder Renault 6.Q.10 engine of 240 h.p. This inverted V air-cooled unit gives the aircraft a reasonable performance, the maximum speed being 189 m.p.h. and the range 740 miles. The payload is given as 1,550lb, and all-up weight 2,645lb. On the score of performance the smaller *Norécrin* does equally well, the inverted V air-cooled four-cylinder Regnier engine of 140/150 h.p. giving it a maximum speed of 165 m.p.h. and a useful range of 560 miles.

Rather in the same class as these is the S.N.C.A.S.E. SE 2311 single-engined four-seater all-metal aircraft which is, apparently, fitted with a fixed tricycle undercarriage. Apparently, since none was fitted, the machine being mounted on pylons. This is quite an attractive little aircraft, and is ably complemented by the pusher tailless SE 2100 on the same stand. The latter is a side-by-side two-seater with a fixed tricycle undercarriage, and in common with most



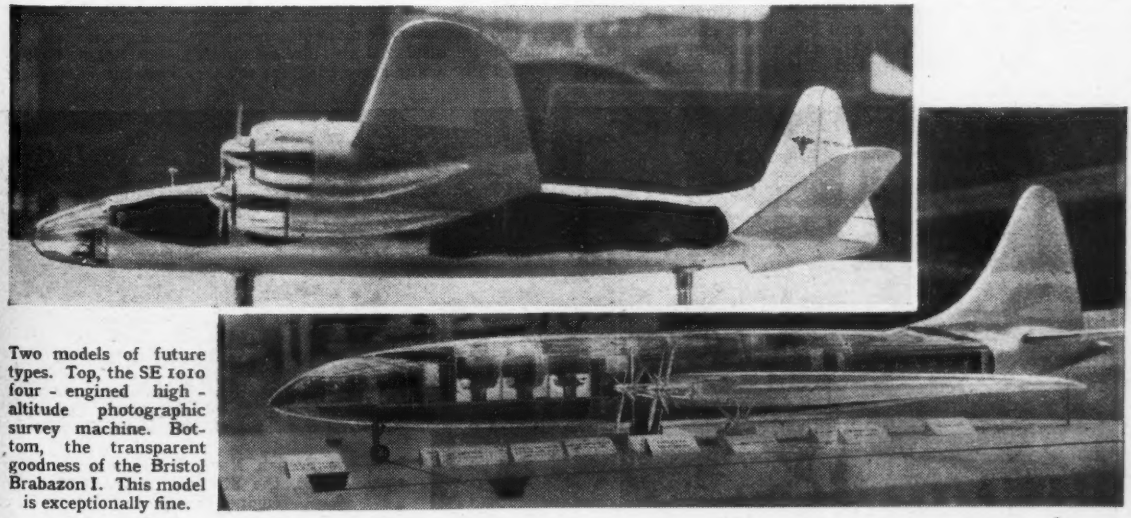
The unusual air-brake of the M.B.175, a standard type of torpedo and dive-bombing aircraft built for the French Navy.

"Manx" types uses a reflex curved aerofoil with fixed built-in leading edge slots forward of the elevons. A neat design point about this aircraft is that the roots of the wing leading edges are built integrally with the doors to facilitate entry and exit from the cabin. End-plate fins and rudders are used but, curiously, the latter work sympathetically and equally over the range of movement which, on the face of things, would appear to incur unequal relative drag components.

Morane Saulnier have on view the MS.560 single-seat all-metal low-wing machine with a lightly framed "bubble" canopy *à la* fighter. This attractive little aerodyne has a retractable tricycle undercarriage, upward-folding wings and its tiny tailplane set at a slight dihedral. A four-seat side-by-side dual-control enlarged version of the above machine is displayed: the MS.571 which, using a Renault 4 P.01 140 h.p. air-cooled in-line inverted power unit, has a maximum speed of 155 m.p.h., a cruising speed at 70 per cent power of 137 m.p.h., and a range (at cruising power) of 620 miles. The all-up weight is 2,310lb and payload 573lb. This little aircraft, by the way, surely is one of the few machines to have flown to Paris—at least judging by its appearance preparatory to being polished for the grand opening.

Attractive High-Wing Model

The French Air Ministry Company is also known by the title of Aerocentre, and among the variety of types exhibited on their stand is a very attractive high-wing single-engine four-seater called the N.C.840 *Chardonneret* (Goldfinch). With a tricycle fixed undercarriage and a light roomy cabin, this machine looks extremely promising. The aircraft exhibited is fitted with a 140 h.p. four-cylinder air-cooled Renault inverted in-line engine, but an alternative power unit is available in the 175 h.p. seven-cylinder air-cooled radial Mathis.



Two models of future types. Top, the SE 1010 four-engined high-altitude photographic survey machine. Bottom, the transparent goodness of the Bristol Brabazon I. This model is exceptionally fine.

PARIS AERO SHOW

The respective performances are given as: maximum speed 130 and 137 m.p.h.; cruising 112 and 118 m.p.h., and range, with either engine, 500 miles. A placard before this aircraft advertises that it has flown 120 hours and has completed 270 landings.

Near this eminently practicable machine is exhibited (by the same company) a two-seater twin-boom single-engined pusher, with the cooling air intake for the engine embodied beneath the port wing root. This aircraft exemplifies the impractical design of front screens by having the profile in an unbroken curve so that the screen is fully 30in ahead of the pilot's eyes, and raked and curved at that. Three engines are alternatively available, all by Regnier, ranging from 73 h.p., through 88/98 h.p., to 148 h.p.

This exhibit has to be regarded rather in the light of a "doodle" by the designer than as a serious attempt to provide a useful flying machine. One must similarly regard a rather curious confection named "le Cab"—a project for a taxi-aircraft with a four-seat side-by-side and facing-one-another cabin placed in front of and below the cockpit holding the pilot and radio operator. The design embraces two 240 h.p. six-cylinder air-cooled in-line Renault engines placed side by side in the nose and driving a four-blade (2 × 2) contra-rotating airscrew. The estimated performances with both engines and with one engine only are respectively: Maximum speeds 250 m.p.h. and 193 m.p.h.; cruising speeds, 225 and 152 m.p.h.; ranges 560 miles and 940 miles.

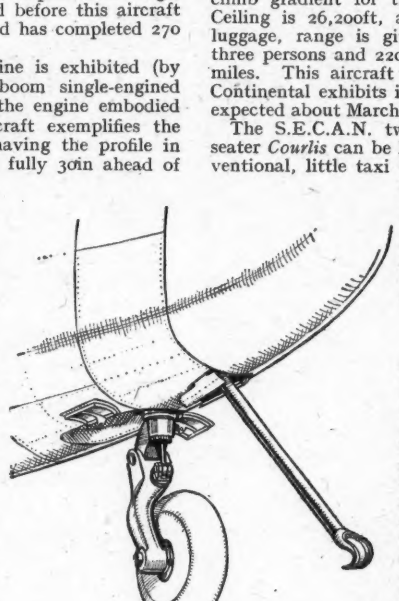
Welcome contrast to "le Cab" is provided by a very Spartan ultra-light biplane — euphemistically called *Le Levrier* (the Greyhound)—which was built by a certain M. Chapeau in his spare time over a period of 18 months. It is a tandem two-seater very cheaply and simply built, and would seem to be very much the sort of thing for the impecunious flying enthusiasts who have lamented in our Correspondence columns the absence of anything like this tiny aircraft in England.

Aerocentre are also now manufacturing a machine they have named the Martinet, and this is immediately recognizable as the German Siebel 204, which was developed during the war as a communications and training aircraft.

The famous French concern of Marcel Bloch have on view a beautifully finished fuselage mock-up of what would appear to be an extremely useful five-seater twin-engined aircraft. Three passengers sit side by side at the back, with the fourth next to the pilot. Behind the seats, on a tray shelf, a useful amount of light personal luggage can be accommodated, whilst larger articles such as suitcases and trunks are housed in a capacious hold beneath and behind the cabin. The aircraft is a low-wing all-metal tricycle (retracting) type with a dihedral tailplane fitted with end-plate fins and rudders. Power is supplied by two Bloch 145 h.p. four-cylinder inverted in-line air-cooled engines, which give the aircraft a very useful performance.

Maximum speed is estimated at 180 m.p.h.; cruising speed at 70 per cent power is 155 m.p.h. With one engine dead the low-altitude rate of climb is given as 395 ft/min, and the climb gradient for this condition is quoted as 5 per cent. Ceiling is 26,200ft, and with four people up and 200lb of luggage, range is given as 370 miles. Alternatively, with three persons and 220lb of luggage, the range goes up to 620 miles. This aircraft is undoubtedly one of the best of the Continental exhibits in its class, and the first flight—which is expected about March next year—will be watched with interest.

The S.E.C.A.N. twin-boom single- (pusher) engined four-seater *Courlis* can be looked upon as a well laid out, if unconventional, little taxi type. In passing it is, perhaps, worthy of note that the private owner category does not seem to figure in French thought. This may be accounted for by the Gallic realism which, conscious of the general financial stringency, labels the various types by utilitarian titles such as taxi, ambulance, etc.



The unusual arrester-hook stowage on the *Noreclair*.

Two Commercials

S.N.C.A.S.O. have two aircraft on their stand which look to be potentially pretty useful. The first is the SO 7010 six-passenger *Pegase*, which is chiefly interesting for its "unit cabin" construction. This is achieved by having the stress-bearing part of the fuselage taken by a keel, above which the cabin is arranged, the walls and roof being merely light unstressed fairings continuing the fuselage contour. The aircraft is powered by a Mathis G.16, which is actually two 200 h.p. V-8 units built with a common crankcase and shaft. Drive is taken through a free-wheeling device to the reduction gear so that should one engine (i.e., half the unit) fail, the other continues the drive. Asymmetric difficulties are thus cut out and, of course, the drag case is reduced.

Complementing the latter aircraft is the SO 90 eight-passenger twin-engined machine (one of the few with a tailwheel undercarriage) which has the remarkable cabin volume of 424 cu ft. In its freight or postal version the payload is given as 2,420 lb, and the all-up weight, as 10,070 lb. Power is provided by two Béarn 6DO7 six-cylinder inverted air-cooled in-line engines of 410 h.p. each for take-off. Performance is given as: Maximum speed 242 m.p.h.; cruising speed 214 m.p.h.; ceiling 19,600ft; and range 750 miles. A tricycle version of this aircraft is available in the slightly larger SO 194 with two 1250 Renaults of 580 h.p. each.

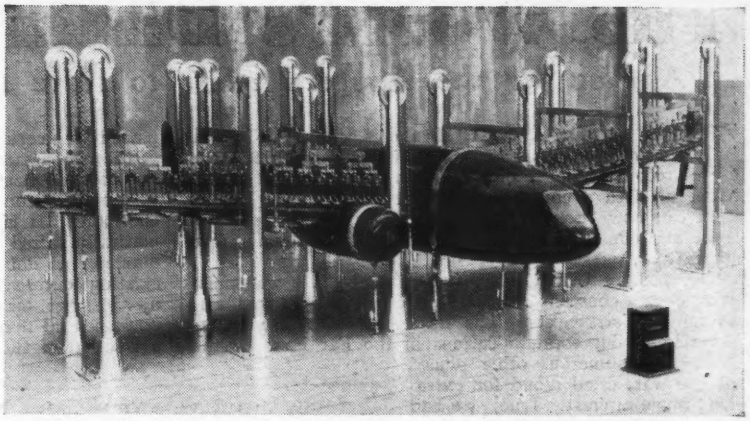
Max Holste is showing the pleasant-looking all-metal two-seat side-by-side tricycle MH.52, which has the excellent aerobatic factor of 12. Powered by a 150 h.p. Potez four-cylinder inverted air-cooled in-line engine, the maximum speed is 142 m.p.h.; cruising speed 130 m.p.h.; and range 370 miles.

The Czechoslovak manufacturers share a common stand, on which are displayed the interesting three-seat Sokol, looking rather like a miniature Proctor; the tiny two-seat side-by-side

Left, the French Navy deck-landing Nord 1500. Right, the SO 30R *Bellatrix* twin-engined transport.

Praga with a central control column; and the rather larger dual-control side-by-side high-wing Avia. These are supplemented by models of a four-seater twin-engined low-wing aircraft which, called the Aero 45, looks neat and swift; a twin-engined low-wing 12-passenger machine, the Letov 101; and the Praga E.210 high-wing twin-pusher 4/5-seat touring, taxi, or cargo type.

Fokker's principal exhibit is the F.25 "Promotor" four-seater with twin booms and hydraulically actuated retractable tricycle undercarriage. Its Lycoming O-435-A 190 h.p. engine gives it a maximum speed of 136 m.p.h.; a cruising speed of 108 m.p.h. at 60 per cent power; and, at this rating, a range of 410 miles. A model of the smaller, two-seat "Partner" on similar lines is shown, and this has the ingenious feature of a complete nose fairing which pivots up on toggle links and moves forward for access to the seats. An 85 h.p. engine is specified, and the estimated performance is: max. speed 112 m.p.h.; cruising 93 m.p.h.; and range 355 miles.



An unusual test rig on the French Armament Ministry's stand. Note that loading is applied via adhesive patches.

Large Commercial Aircraft

ON entering the Salon the visitor will, as likely as not, stop in his tracks and goggle at the looming fuselage of the NC 211 freighter—*Le Cormorant*. This is France's first big cargo carrier and weighs about 84,000lb. The prototype is nearly complete at the Billancourt factory of S.N.C.A.C. The following quotation of data is justified by the exceptional interest now current in aircraft of this sort: Span, 144ft; height of fuselage, about 18ft; cargo+fuel load, 37,450lb (including seven "steerage" passengers on the top deck); cruising speed, 198 m.p.h.; landing speed, 87 m.p.h. *Le Cormorant* carries a crew of three and has four S.N.E.C.M.A. 14R radials. It is difficult to imagine the appearance of the complete aircraft from the fuselage alone, but it is a shoulder wing design with nose-wheel undercarriage having double wheels. Bulky cargo, e.g., lorries, is loaded through clam-shell nose doors via a ramp. Laid out solely for passenger carrying the NC 211 will seat 131-150.

This French "pantechnicon" is, of course, much more capacious than Bristol's Freighter, already acclaimed by operators in several countries as the finest medium-size cargo-carrier extant (Bristols show their exquisite transparent models of the Freighter and Wayfarer) and is more nearly comparable with the Breguet 761 two-decker likewise displayed as a model, with a lorry on the top deck. On the 761 the entire rear-bottom part of the fuselage is hinged to permit loading by ramp. Like Saunders-Roe at Radlett, Breguet exhibit a specimen fuselage frame to convey an impression of size, but somehow it seems to fail in this object though, in all conscience, the machine is bulky enough. Like the *Cormorant* it will weigh over 80,000lb. The useful load is given as 39,650lb.

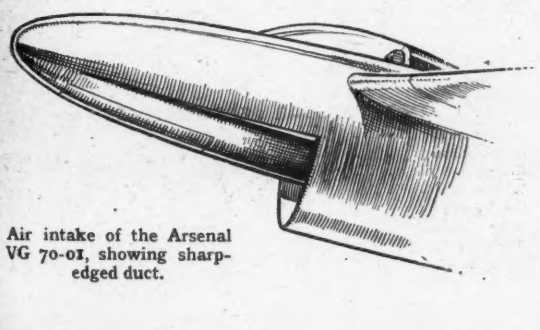
The Breguet 500 transport, of which drawings are displayed, is to have a span of 259 feet.

On the S.N.C.A.S.E. stand is a mock-up section of fuselage to illustrate the internal arrangement of the 154,000lb S.E.2010 transport now being built at Toulouse, one version of which is planned to take 160 passengers and 14,000lb of freight for 930 miles, cruising at 286 m.p.h. The outside diameter of the circular-section fuselage is about 15½ feet. One gathers that the wing is similar to that of the SE 200 flying boat. Pratt and Whitney engines will be fitted initially, but Arsenal 24Hs are mentioned as a future possibility.

Various four-engined commercial transports are projected by the same company, and due to the French system of designation some confusion has arisen between these, though the models and drawings shown are well annotated. Of these types the SE 1010 is a high-altitude photographic survey machine, the SE 1030 a "public transport," and the SE 1001 a long-range "courier" type for mails and passengers. The SE 1010 is a particularly interesting design with four 14R engines, pressure cabin, completely transparent nose and very elaborate survey equipment. It is to operate at about 32,000 feet and cruise at 285 m.p.h.

The *Sud-Est* organization, of course, manufactures the four-engined Bloch 161 *Languedoc* which lately visited England and is doing good work with Air France.

Other large commercial aircraft will be described and illustrated in our next issue, together with various types of smaller aircraft and power plants and helicopters which are not covered by the descriptions on pages 569-571 of the present issue.



Air intake of the Arsenal VG 70-01, showing sharp-edged duct.

The Nene-Lanc. Flies to Paris

THE flight of the Nene Lancaster from London to Paris last Monday, to play its part in connection with the exhibition, may be said to have marked a historic point in British aircraft development, for it constituted the first time that any jet-powered airliner had flown from one country to another. Moreover, since this particular aircraft has been flying fairly regularly since round about the time of the Radlett exhibition, the flight to Paris was no special performance, but merely one more public demonstration of its inherent reliability.

In the hands of Capt. R. T. Shepherd, chief test pilot for Rolls-Royce, the "Nene Lanc" landed at Le Bourget at 10.58 a.m. G.M.T., after a 50-minute flight from London Airport, giving an average speed of 247.5 m.p.h. Two passengers were carried in addition to the crew; they were Mr. Roy Chadwick, the Avro designer, and Mr. R. B. William Thompson, Chief Information Officer of the Ministry of Supply.

Capt. Shepherd said that he was very pleased with the aircraft's performance and added that, but for having to circle Le Bourget Airport twice before landing, the flight would have been completed in 43 minutes.

SAILPLANE DESIGN PRIZE

SINCE the recent announcement that the Duke of Sutherland has donated £125 to the British Gliding Association, to be used as a prize for a design competition for a high-performance two-seater sailplane, over thirty competition numbers have been applied for and allocated, and numerous enquiries, with a view to further entries, have been received at the B.G.A. offices.

It is emphasized that the competition is not limited to individuals or groups of people, but is open to firms as well. The requirements for the design remain as before, except that the weight of the two pilots with parachutes has been increased to 400 lb or over, instead of the original 331 lb.

This good response to the competition emphasizes the skill and keenness latent in the British gliding movement, but it needs more encouragement from the Government, both financially and morally.

The World's Distance Record

A Plea for the Airspeed AS57 to Have Its Claims Considered

By JOHN W. MORRISON

THE outstanding feat of the Lockheed Neptune *Truculent Turtle* in establishing a world's distance record at the resounding figure of 11,236 miles provides us with a convincing demonstration of the results that can now be achieved by embodying the latest aerodynamic refinements in an otherwise orthodox long-range aircraft.

Our lack of U.L.R. aircraft during the late war must have been a constant source of anxiety and embarrassment to military strategists. The Battle of the Atlantic, the severing of our communications in the Far East by the Japs, and numerous other phases of the war, cried aloud for extra-long-range aircraft. True, we had a number of so-called U.L.R. machines in the later stages of the conflict, but they were not British aircraft.*

On the civil transport side, it would be difficult to overstate the salutary impact which the world's distance record *could have* on the percentage payloads of transoceanic aircraft. Too little revenue load and too much fuel spells exorbitant passenger fares. The aircraft with the lowest drag coefficient may be more difficult to make, it may be more expensive, but it will pay the biggest dividends in the end.

Do we possess any aircraft potentially capable of beating the distance record by an appreciable margin? If the answer to this question is in the affirmative, we are entitled to claim that we can build the most efficient long-range machines. In my humble submission, the Airspeed AS 57, with suitable modifications, is potentially capable of regaining the record for us without bothering about rocket-assisted take-off or other external aids. Only in the Ambassador do we find in full measure that skilful compounding of advanced aerodynamic characteristics now so essential for extreme range. These characteristics are:—

(1) High-wing arrangement with optimum lift distribution.
(2) High main plane aspect ratio, 11.02.
(3) High-lift low-drag laminar-flow wing section N.A.C.A. 65.
(4) Only moderately thick wing root section, 16.5 per cent.
(5) Low normal wing loading, 37.5 lb/sq ft.
(6) More than two-thirds of the wing area clear of the airscrew slipstream.
(7) Low internal and external drag cowling of the Bristol Centaurus engines, together with a big step-up in power (840 h.p.) after the design had been crystallized.

The fuselage is the only feature of the AS 57 that could place it at a certain disadvantage. The maximum diameter of the Ambassador fuselage is 2ft greater than that of the Superfort *Dreamboat*, although the latter is twice the size, and by comparison with the Lockheed *Neptune* it is enormous. It is, therefore, suggested that a new mathematically faired streamline fuselage, having a maximum diameter of not more than 9ft, suitably faired into the existing centre-section and tail assemblies, is needed. This new fuselage, initially *sans* doors, freight hatches, windows, non-essential flooring and bulkheads, would call for only a fraction of the stressing and cost of fabrication of the normal one. Far from being worthless for anything other than record attempts, it might form the basis of an R.A.F. Transport Command U.L.R. personnel and communications machine, with or without R.A.T.O.G.

Since the Ambassador does 2¼ air m.p.g. at 10,000ft and 180 m.p.h. at normal weight, 6,000 Imperial gallons of fuel should suffice for a non-stop flight from London (Heathrow) to Auckland, New Zealand, a distance of some 12,500 miles.

Using Airspeed's weight figures as a basis, we then get the following new build-up:—

	(Wt. lb.)
Structure	16,570
Power Plant	10,000
Electrical services, etc.	2,020
Fuselage tanks (2,000 galls.)	340
Crew accommodation	250
Tare weight	29,180
Fuel (6,000 galls.)	43,200
Oil (240 galls.)	2,160
Crew of five	1,000
Miscellaneous items	460
All-up weight (lb)	76,000

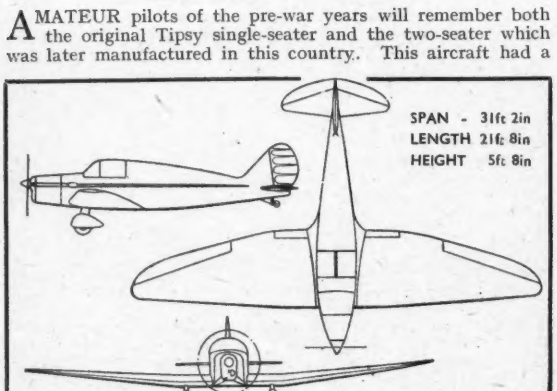
Since almost all of the 31,000 lb overload weight would be carried in the wing in the form of relieving loads, the flight factor would not be seriously impaired. A take-off power loading of 12.66 lb/b.h.p. is about 75 per cent better than the figure normally used for record purposes.

Used subsequently as a R.A.F. U.L.R. personnel transport, at a maximum loaded weight of, say, 70,000 lb, the integral wing tankage alone would provide a still-air range of about 9,000 miles with 3 tons of military load.

* Work was also done on converting Lancasters for flight refuelling.—ED.

THE TIPSY AGAIN

AMATEUR pilots of the pre-war years will remember both the original Tipsy single-seater and the two-seater which was later manufactured in this country. This aircraft had a side-by-side seating layout, and a substantially similar aircraft, known as the Tipsy Belfair, is now being made by Avions Fairey at Gosselies, Belgium, and, in fact, represents the first tangible sign of production from the Belgian Fairey factory since the German occupation.



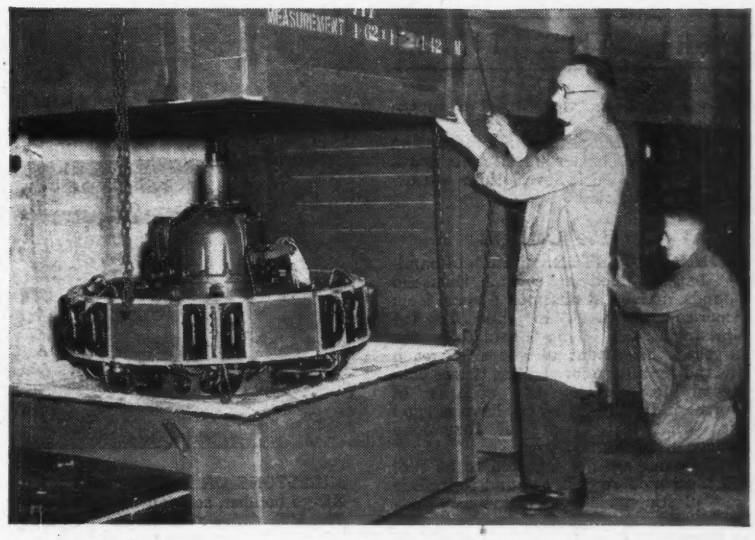
In its latest form the Belfair has an enclosed side-by-side seater cabin, with the rear part of the hood hinged and the whole detachable. It is powered, as in pre-war days, by a Walter Mikron 62 h.p. engine, which gives it a cruising speed of 100 m.p.h. The normal range is 465 miles.

A limited number of these aircraft is being assembled over here by the Tipsy Aircraft Company, which is a subsidiary of the Fairey Aviation Company at Heston.

TIPSY BELFAIR PERFORMANCE

Stalling speed	37 m.p.h.
Rate of climb	500ft/min
Ceiling	20,000ft.
Take-off run	85 yd
Landing run	65 yd
Wing loading	8.5 lb/sq ft
Power loading	17.8 lb/h.p.
All-up weight	1,100 lb

HERE AND THERE



PUTTING THE LID ON IT : Another British aircraft engine being packed for export. This time it is one of a number of Armstrong Siddeley Cheetahs for South America.

Waiting for It

ONE of the most unusual stories connected with aviation ever to be told must surely be last week's adventure of the B.O.A.C. Liberator which had to stooge around over Heathfield, near Prestwick, for 9¾ hours to use up its 2,500 gallons of fuel before making an emergency "crash-landing" with a jammed undercarriage that left one wheel up and one down.

Thanks to the cool skill of its veteran pilot, Capt. J. N. Wilson, a belly-landing was safely made and nobody was hurt.

One can well imagine the mental strain imposed on everyone aboard during all those weary hours of "waiting for it," but Wilson obviously did the right thing—as everyone acquainted with him knew he would.

Lucky Numbers

AIRLINE passengers whose bookings happen to register nice large round numbers in the operators' records are apt to be lucky people these days, for it is evidently becoming the fashion to single them out for some gesture of generous appreciation—in the interest of publicity, of course.

Recently, Channel Islands Airways (for example) gave such a passenger a free ride from Jersey to England and the makers of the aircraft which carried him weighed in with a well-stocked cigarette casket on his arrival. Now Trans-Canada Airlines has honoured its millionth passenger, a lady from Vancouver, to whom was presented a suitably inscribed wrist-watch and an orchid corsage.

Regular passengers on the line will be entitled to feel duly envious of her good fortune, since it was only the second time this prizewinning passenger had ever travelled by air.

Thor II was Delayed

BAD weather on the transatlantic route delayed the departure of *Thor II*, the Empire Air Armament School's specially equipped Lincoln, which, as announced in *Flight*, October 24th, was to have flown to Canada and America at the end of last month, and the mission did not arrive in Ottawa until Wednesday of last week.

The aircraft is fitted with the latest armament and radar equipment and the mission is headed by Air Vice-Marshal G. Combe, C.B., who is accompanied by (among other experts) Grp. Capt. R. H. E. Emson, C.B.E., A.F.C., the Assistant Commandant at Manby.

Wing Cdr. M. H. de L'Everest is captain of the aircraft, and it will be remembered that he also captained the Lancaster, *Thor*, on its earlier liaison missions to Australia, New Zealand, and South Africa.

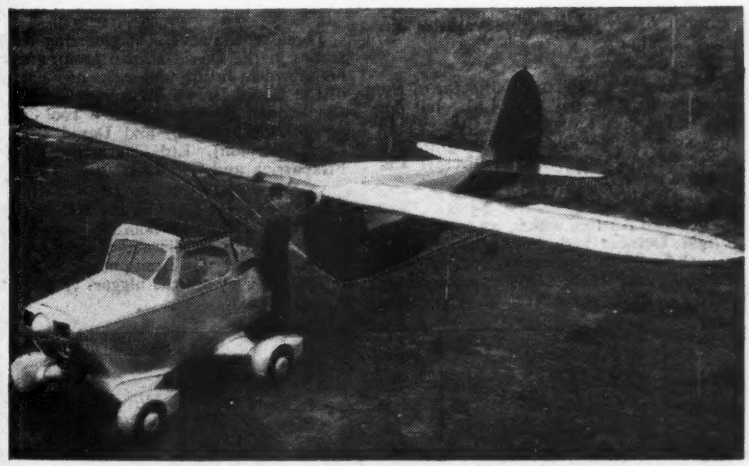
"Incredible Progress"

IN cabling from Washington a report that a contract for the development of an atomic aircraft engine has been given to a large U.S. aircraft company, a British United Press correspondent says that there is "no indication when the atomic engine will reach the test stage" but that the move indicates the "incredible progress" made by American scientists in this field.

The firm concerned is at present carrying on experiments, he adds, and "certain fundamental points can be disclosed."

These are, presumably, that the engine will resemble a rocket-type power plant, and that "the most difficult problem at present is how to provide an effective shield to protect the crew from the deadly atomic rays."

Without wishing to appear unduly sceptical, we can think of at least one other major problem, too!



ANOTHER TWO-IN-ONE : Latest U.S. version of the car-cum-plane, designed by Robert E. Fulton and built by Continental Inc., is this "Airphibian" in which the flying surfaces and rear fuselage detach in one unit as shown. Air and road speeds are 125 m.p.h. and 45 m.p.h., but we shudder to think of the road tax in Britain!

Get in the Queue

YET another of the 30,000 people still waiting for transport to South Africa has solved the problem by purchasing his own aircraft to fly there.

This is Mr. Gordon Simpson, of Surbiton, who has bought an Airspeed Consul (civil version of the celebrated Oxford trainer) and, with ex-R.A.F. Mr. P. R. Matthews as pilot, will be off to Durban before the end of the month.

Mrs. Simpson, Mrs. Matthews, and a four-months-old baby complete with cot make up the "passenger list" this time, but Mr. Matthews tells us that they have had so many requests from friends that he is thinking of making a number of trips between the U.K. and Africa to ferry a few of them out there. As he has over 1,500 "Oxford" hours in his

HERE AND THERE

Service log book, the Consul is in experienced hands.

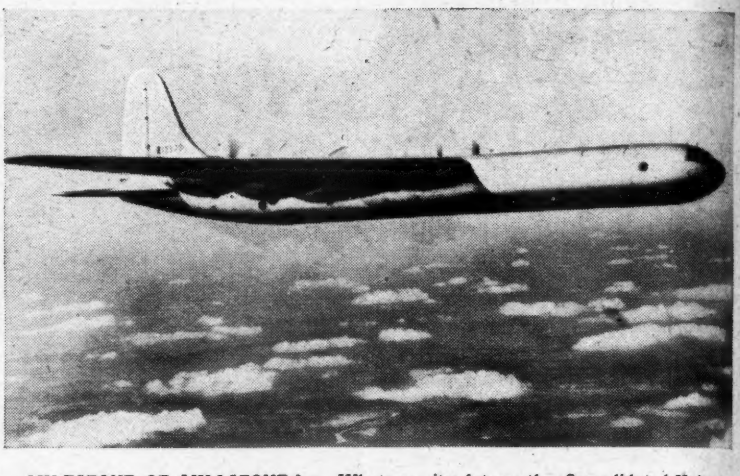
Later, Mr. Simpson thinks of setting up in the air charter business in South Africa, where, he believes, there are excellent possibilities.

For the Colleens

THREE-QUARTERS of a ton of handbags, valued at several thousand pounds, arrived at Shannon Airport from America last week in time for the Christmas sales. This is said to be the largest consignment of goods to reach Ireland by air, so far, and as it was consigned to Belfast, the colleens of Northern Ireland will now have a good idea what sort of present they may receive from Santa Claus.

The handbags are reported to be " of the most modern design " and to include new plastic models not previously seen in Ireland.

America's export drive is evidently getting well under way.



MILESTONE OR MILLSTONE ? : Whatever its future the Consolidated-Vultee XB-36 bomber, seen on one of its first flights, reflects credit on its manufacturers. The U.S. Army now claims that it will carry an atomic bomb to any inhabited region of the world and return without refuelling.

News in Brief

MR. GEOFFREY TYSON is resigning his post of chief test pilot at Shorts and is taking up a similar post with Saunders-Roe at Cowes.

* * *

Dr. Sanford A. Moss, the American pioneer of turbo-supercharging, died on November 10th. When work on turbine jets began in the U.S.A. Dr. Moss was recalled from retirement by the General Electric Company and took part in much of the early development.

* * *

The Pathfinder Association is holding its Grand Pathfinder Dance at the New Royal Horticultural Hall, Westminster, London, on Saturday, November 30th, from 7.30 p.m. Tickets are 5s 6d each and dress is optional.

* * *

B.O.A.C. have announced, with emphasis, that there are no more vacancies for stewardesses on their Constellations operating the London-New York services. All such posts have been filled by young women selected from those previously employed by the corporation.

* * *

A Norwegian Dakota arrived at Colombo, Ceylon, recently, carrying a 2,000lb crankshaft for a Norwegian motor ship lying disabled in the harbour there. Captained by an ex-R.A.F. pilot, it had flown the 6,500 miles from Oslo in 41 flying hours.

* * *

The first post-war Russian dirigible, *The Patriot*, was completed recently at an airfield near Moscow. She is 160ft long, 48½ft in girth, has a gas capacity of 120,000 cu ft, and will carry 10 to 12 passengers. Powered by two 1,700 h.p. engines, she is reported to be capable of cruising at over 60 m.p.h. and to have a ceiling of 15,000ft.

* * *

M. Andre Moynet, who at 25 is France's youngest M.P., was a Spitfire pilot with the Fighting French Air Force operating from Britain during the war, and later served on the Russian front with the French "Normandy-Niemen" Squadron. He has 12 enemy aircraft destroyed to his credit and wears two Red Army decorations and 12 Bars to his Croix de Guerre.

* * *

A Diamond Jubilee celebration in the form of a dance and cabaret show was held by Shannon, Ltd., last week at New Malden. During the evening presentations for long service were made to a number of the firm's employees by Mr. E. F. Shannon.

* * *

Mr. Kenneth Mollart, a director of the Mollart Engineering Co., Ltd., left for the U.S.A. and Canada recently to study jig, tool, gauge and measuring instrument design as applied to aircraft and other engineering products.

* * *

The two Austers which, as recorded in *Flight*, October 17th, left Cambridge last month to fly to Ceylon, arrived safely at Colombo last week. One was owned by Mr. A. P. Obeyesekere, a Singhalese, who had ex-R.A.F. Ralph Sleigh as pilot, and the other was owned and flown by ex-R.A.F. Sqn. Ldr. R. A. Farquarson. This approximately 7,000-mile flight is believed to be the longest yet undertaken by any light aircraft.

* * *

Another " safe arrival " by these long-distance light aircraft has been reported from Salisbury, Rhodesia, namely the trio flown out there from Lympne in 15 days by Messrs. Posselt, Alsop and Langley respectively. Mr. Posselt is chief pilot of Rhodesian Aircraft Maintenance and Services, Ltd.

* * *

Mr. H. W. Harper, until recently works manager of the Avro factory at Yeadon, has left the company, which he joined in 1930, to take up a new appointment in the Midlands. On October 31st he was presented with a silver cigarette case by Mr. Roy Chadwick, chief designer, in the absence of Sir Roy Dobson.

* * *

Three of the several engineering companies in the David Brown group are to be known in future under the new names of the David Brown Foundries Company (Penistone), the David Brown Tool Company (Huddersfield), and David Brown Gear (London), Ltd., formerly C. J. Fitzpatrick and Co., Ltd.

* * *

The Goodyear tyres on the XB-36, the largest land-based bomber to date, measure 110in in diameter, 44in across the beads, and 36in from one side wall to the other; they are the biggest tyres ever manufactured.

AIRSTRIP . . . . No. 40

FORCED LANDING BY HELICOPTER

Some Imperfectly-understood Aspects of the Correct Technique Discussed

By WING COMMANDER REGINALD BRIE

Wing Cdr. R. C. Brie

THE author of this article has been flying rotating-wing aircraft for a great many years, first as demonstration pilot of Cierva Autogiros and, during the war, of helicopters. He was in charge of helicopter training and all rotating-wing flying in this country, and spent a considerable period in America.

In this article Wing Commander Brie gives advice on how to minimize the risk of forced landings in case of engine failure, and pleads for better power/weight ratios to improve performance.

IN discussing certain aspects of helicopter performance, it has to be borne in mind that all the practical knowledge and experience in this country up to the present is based on the Sikorsky R-4 type. This product of American ingenuity was designed in 1941, and it emerged as a production model for wartime purposes during 1943.

Such was the urgency of its intended use (as a trainer for the pilots and maintenance crews who would be handling the operational and more powerful R-5 model in the anti-submarine campaign) that only absolutely essential modifications were allowed to interfere with the production schedule.

With many thousands of flying hours in all parts of the world to its credit, the R-4 has achieved all that was expected of it. The surprising thing is not that the helicopter as we know it has a poor efficiency rating, but rather that it works and performs as well as it does.

Vertical Climb

Owing to its low power/weight ratio the vertical climb characteristic of the R-4 is critical. Under still-air conditions, and with maximum all-up weight, it is only at sea level that this aircraft is just capable of hovering within the ground cushion created by the rotor downwash. Naturally some improvement can be effected by a reduction in load.

"*Flight*" photograph.

A Sikorsky R4 helicopter hovering at a low height

Broadly speaking, the mechanical difference between the single rotor helicopter and the Autogiro is a fine one, for the major elements of Cierva's classic creation remain essential features of design for any practical type of helicopter. One of these is that the main rotor must be capable of autorotation in the event of power failure, and this fundamental safety feature is achieved by the simple expedient of a simultaneous reduction in the pitch of all blades. Under those conditions the helicopter becomes an Autogiro; or, to use the generic term for aircraft with freely rotating rotor systems, a rotocraft.

Aerodynamically and qualitatively, however, there is a marked difference between the performance and handling characteristics of the two types. First because, during the transition stage from helicopter to Autogiro, there is a control time lag associated with blade-pitch change. Secondly because the helicopter has a higher disc loading. As a result, the helicopter without power loses height more rapidly, and from any given altitude has a lower gliding range than the Autogiro. Consequently, under comparable conditions of emergency, there is less time available to carry out essential manœuvres, and a more restricted choice of landing areas.

In an article by Lt. (A) C. T. D. Hosegood, R.N.V.R., in the March 28th, 1946, issue of *Flight*, the author gave a lucid explanation of the technique governing autorotative landings from: (a) vertical approach; (b) glide approach and landing with forward speed; and (c) glide approach and landing with zero air speed. It is an elaboration of (a) with which the present article is concerned, and more particularly with the influence of the helicopter's hovering-flight characteristics on its operation from restricted areas.

Without Power

It is now generally accepted by those who are interested in, but possibly not very knowledgeable about the aerodynamics of, rotary-wing flight, that there is no difficulty in ensuring that the rotor of a helicopter will continue to function satisfactorily without power. On the other hand, there are many who still hold the erroneous impression that the only possible result of power failure soon after take-off must be little short of disaster. That such a happening *could* be serious is indisputable, but that it *must* be so is far from being the case.

With any type of helicopter, the worst condition for take-off is in vertical ascent with maximum all-up weight in still air. On the other hand, the rate of climb is appreciably improved with some forward speed, or alternatively with any increase in the natural wind velocity.

Conversely, it also holds good that in a power-off autorotational descent at zero forward speed in still air vertical acceleration is at a maximum, but that this rapid loss in altitude is lessened during a glide or with the assistance of a head wind.

It will be obvious that any increase in the volume of air encountered by the rotor has a beneficial effect on the

FORCED LANDING BY HELICOPTER

rate of climb with power, or on a loss in height without power. Whether the extra volume derives from a natural wind or from an artificial one created by the aircraft's forward motion is immaterial. The flight path during a true vertical descent can only be perpendicular to some fixed point on the ground, so that it is only under still-air conditions that the maximum rate of descent can take place.

For any take-off from a restricted area, the limiting factor is the height of obstacles to be cleared. If, therefore, during the initial stages of vertical ascent in still air it is found that there is insufficient lift to sustain the aircraft at an altitude greater than that of such obstacles, then a powered descent would be made, and the flight temporarily abandoned.

The reason for this action is associated with the pronounced inertia of the aircraft at ultra-slow forward speeds. During the transition period from zero (hovering) to forward speed, the change in longitudinal trim (occasioned by the necessary forward movement of the azimuth control to bring about the desired acceleration to increase the rate of climb) will, in fact, result initially in a slight loss of height. Consequently, with an experienced pilot, no hazard is involved during this manœuvre, because before attempting to continue the flight he would take the precaution to ascertain whether the necessary initial altitude might or might not be reached.

Artificial Calm

It may well be, of course, that during a take-off the obstacles ahead may so impede the natural wind effect as to bring about a simulation of still-air conditions on the leeward side. In that case, turbulence associated with downwash would be experienced during the initial stages of ascent, but the wind effect would materially assist the rate of climb once the altitude of the aircraft exceeded that of the obstacles.

Alternatively let us assume a helicopter with a substantial hovering ceiling above sea level, and that during a vertical ascent from a restricted area in still air, power failure occurred at 200 feet. Under such conditions the results probably *would* be somewhat unfortunate, for the take-off area would be screened from the pilot's view by the fuselage, thus adding to his difficulties. Here an error of judgment is involved, for the correct procedure would have been to continue the second stage of the ascent *in reverse*, thus keeping the take-off area continually in sight, and at the same time ensuring a positive glide-path approach to facilitate correct positioning for the final stages of a possible autorotative descent.

From the foregoing it will be evident that there exists a critical hovering altitude for any type of single-engined helicopter. For all practical purposes this can be placed at between 50 and 250 feet above ground level. The optimum condition is in still air, and it is immaterial whether power failure takes place during vertical take-off or vertical approach to land. The hazards are considerably reduced if the landing area is not unduly restricted, and the limitations of the aircraft are fully appreciated.

However attractive operation from restricted or confined areas may be, for this is the most publicized characteristic of helicopter performance, reasonable caution must be exercised to ensure that it is not overdone. The basic requirement for commercial operation is that the elevation of the take-off area should not be inferior to that of the highest obstacle in the immediate vicinity; and that it should be sufficiently large to enable an involuntary landing immediately after take-off to be accomplished with reasonable facility.

Twin-engined Transport

For the bigger transport types of helicopter the only real safeguard will be provided by a twin-engine installation, so that height can be maintained in the event of partial power failure.

Now that the engineering requirements for the single-rotor type of helicopter have been established, the immediate major aim should be to incorporate certain essential refinements in detail design which will improve performance, facilitate operation, and simplify pilotage.

A high power/weight ratio is synonymous with a good vertical rate of ascent, and the most logical and direct method to achieve this is by the elimination of unnecessary structural weight. For many years the performance of rotary-wing aircraft has been hampered by what might be termed "heavy engineering," and there is considerable scope in this direction for the exercise of ingenuity by engineers who can design lightness.

This saving in weight will also contribute materially to an appreciably lower rate of vertical descent. For all practical purposes a helicopter should be capable of being landed with the facility of an Autogiro. Qualitatively there is at present a marked difference between the two in this respect.

There is no doubt about the potential weight-lifting characteristics of the helicopter, but efforts to exploit this desirable feature must not be at the expense of take-off. The maximum permissible all-up weight should be based on a minimum vertical rate of ascent in still air, otherwise the trend will be towards a vicious circle, and we shall continue to operate in our own downwash.

RADAR IN "UNESCO" EXHIBITION

ON behalf of the Ministry of Education, the British Council has arranged for British contributions to the international exhibitions being held in connection with the first general conference of the United Nations Educational, Scientific and Cultural Organization, meeting in Paris from November 19 to December 10.

In the field of science the main British contribution is the radar section, where there will be displayed a selection of pre-war and wartime service equipment, with two post-war developments of this new art for civil use. The radar exhibit has been collected and prepared by a working party under the chairmanship of Mr. L. S. Harley of the Central Radio Bureau.

The radar exhibits have been arranged to explain the fundamental difference between radar and television, to show historically the development of radar, and to give an idea, by selected photographs, of the results obtained. There will, for example, be a demonstration of the bomber radar equipment used to distinguish from the air the various features of the earth's surface, both natural and artificial; another demonstration by means of models of detection of submarines from the air, and a Gee navigation equipment will be shown in operation.

It is hoped, also, by means of an installation in a boat on the Seine, to give a demonstration of radar as used to navigate merchant vessels at sea, while historically-interesting land, sea and air equipment will be shown as a background to recent achievements.

There is a small Genetics exhibit prepared by Dr. C. E. Darlington, Director of the John Innes Horticultural Institution. There is also some material illustrating the development of Sino-British science co-operation through the British Council's Cultural-Scientific Office in China, directed for three years by Dr. Joseph Needham, including contributions from Chinese scientific organizations of samples of instruments.

U.S. EMERGENCY PLAN

IN the event of a national emergency, the U.S. will select jet aircraft for mass production, it was announced by Air Material Command Headquarters in Dayton, Ohio, last week.

"A large percentage of the models selected is based on the current trend in combat aircraft towards jet propulsion," the official statement said.

Plans for an emergency are to be kept up to date with changes in military strategy and in industrial research, as and when circumstances suggest.

During the Second World War, the average time from design to testing in combat for a U.S. aircraft was four to six years, which might be a bit too long next time!

The Airspeed Consul is an inexpensive medium-sized charter or feeder-line type which should be of interest to operators abroad. With 5-6 passengers it has a range of more than 400 miles and an economical cruising speed of 145 m.p.h. The aircraft here shown is one of a number now being prepared for export.

Sold Abroad

Aircraft which Figure in Britain's Growing Export Trade

THERE are in existence today British aircraft for almost every conceivable purpose and, while some do not represent the latest ideas of the designers, they are for the most part adequate for the job in hand. Today the world's buyers are generally more interested in a good aircraft available at the right time and place than in a super aircraft for which no delivery time can be quoted. Britain, still somewhat handicapped by six years devoted entirely to war production, is nevertheless rapidly recovering, and is already able to make a very good showing in the world's aircraft markets.

On these pages are illustrated a variety of British aircraft which have been delivered to foreign buyers during the past few months. Some are late wartime or post-war designs, such as the Vickers Viking and de Havilland Vampire, whilst others like the Avro XIX, Airspeed Consul, Short Sunderland (becoming a Sandringham) and Handley Page Halton are conversions of earlier military aircraft. In another class are certain specialised aircraft to be used in their wartime form, an example being the Miles Martinet for target towing.

Besides those illustrated, there are a number of new aircraft ordered, delivered, or ready for delivery abroad. These include in particular the Bristol Wayfarer and Freighter, and the de Havilland Dove. In addition there are the Miles Aerovan, the earlier Magister, and the Percival Proctor.

Another few months will see the majority of a substantial number of British prototypes—some flying, others about to fly—in production and service, and the prospects in world markets will look even brighter. Moreover, it may well be that the marked superiority of British power units large and small, will result in their adoption in increasing numbers for use in foreign aircraft.

A flight of de Havilland Vampire jet-propelled fighters, fitted with D.H. Goblin turbine-jet units, has been delivered to the Swiss Air Force. The Vampire's exceptional rate of climb should prove greatly beneficial in Alpine country. One of the Swiss Vampires is here seen demonstrating.

Units of the Royal Netherlands Naval Air Service are equipped with Fairey Firefly I deck-landing fighter-reconnaissance aircraft. A batch of Firefly IVs has also been ordered.

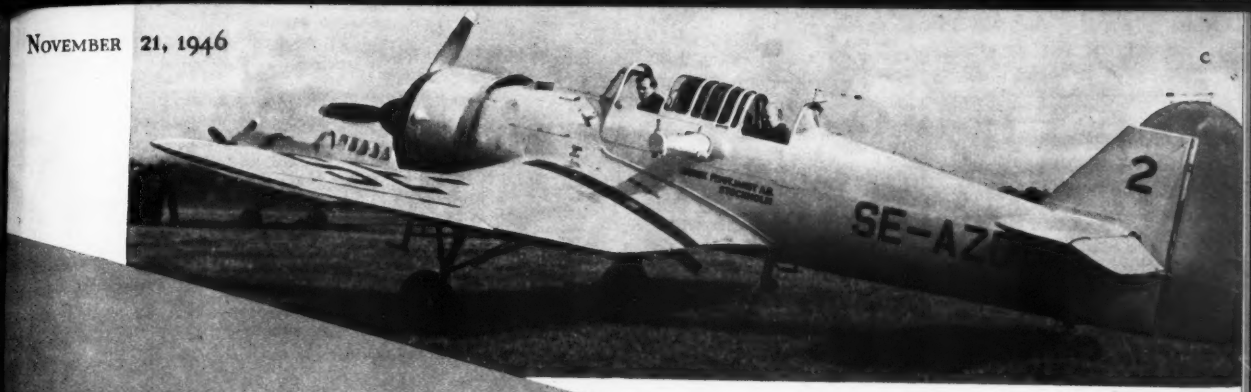
At the moment of writing, orders for more than forty Viking have been placed by foreign airline operators. This is in addition to the large number already purchased by B.E.A.C. The largest foreign order has come from the Argentine Government, to which this particular aircraft is due to be delivered.

Sold Abroad

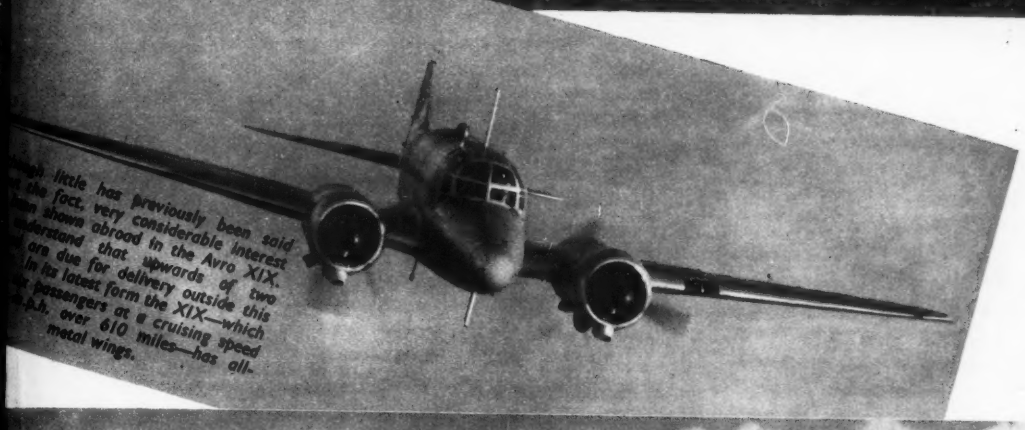
Amongst the not numerous private-t types so far availab this country is the Messenger, an exam which, shown here, been purchased by owner in Switzerland Messenger cruises more than 110 with a pilot and passengers, and unusually safe ch teristics.

A Short Sandringham flying boat supplied to D.O.D.E.R.O., the Argentine airline. The Sandringham is a later model than the converted Sunderland, now giving excellent service, and combines exceptional comfort with long range and the legendary reliability of the wartime Sunderland. An even later and more powerful Short flying boat is the Solent.

A Handley Page Halton transport, with four Bristol Hercules engines, supplied to His Highness the Gaekwar of Baroda. The Halton is a civil development of the well-tried Halifax bomber and has a maximum speed of 320 m.p.h. With normal tankage the range is over 2,400 miles.

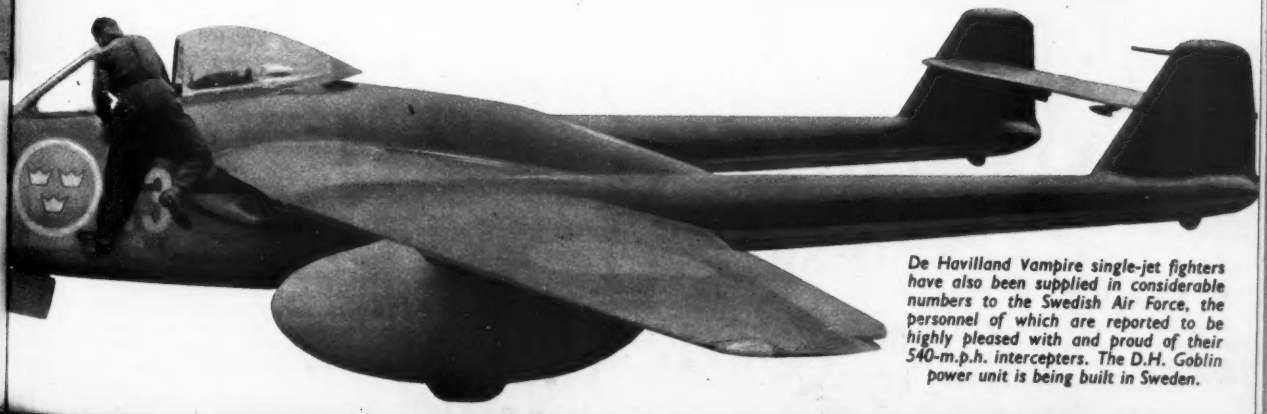


A Miles Martinet target-towing aircraft, with Bristol Mercury engine, purchased by Svensk Flygtjänst A.B., of Stockholm. This and other machines of its type, will be operated under contract to the Swedish Air Force. The Martinet is a standard target-tug in the R.A.F. and is a development of the Master advanced trainer.



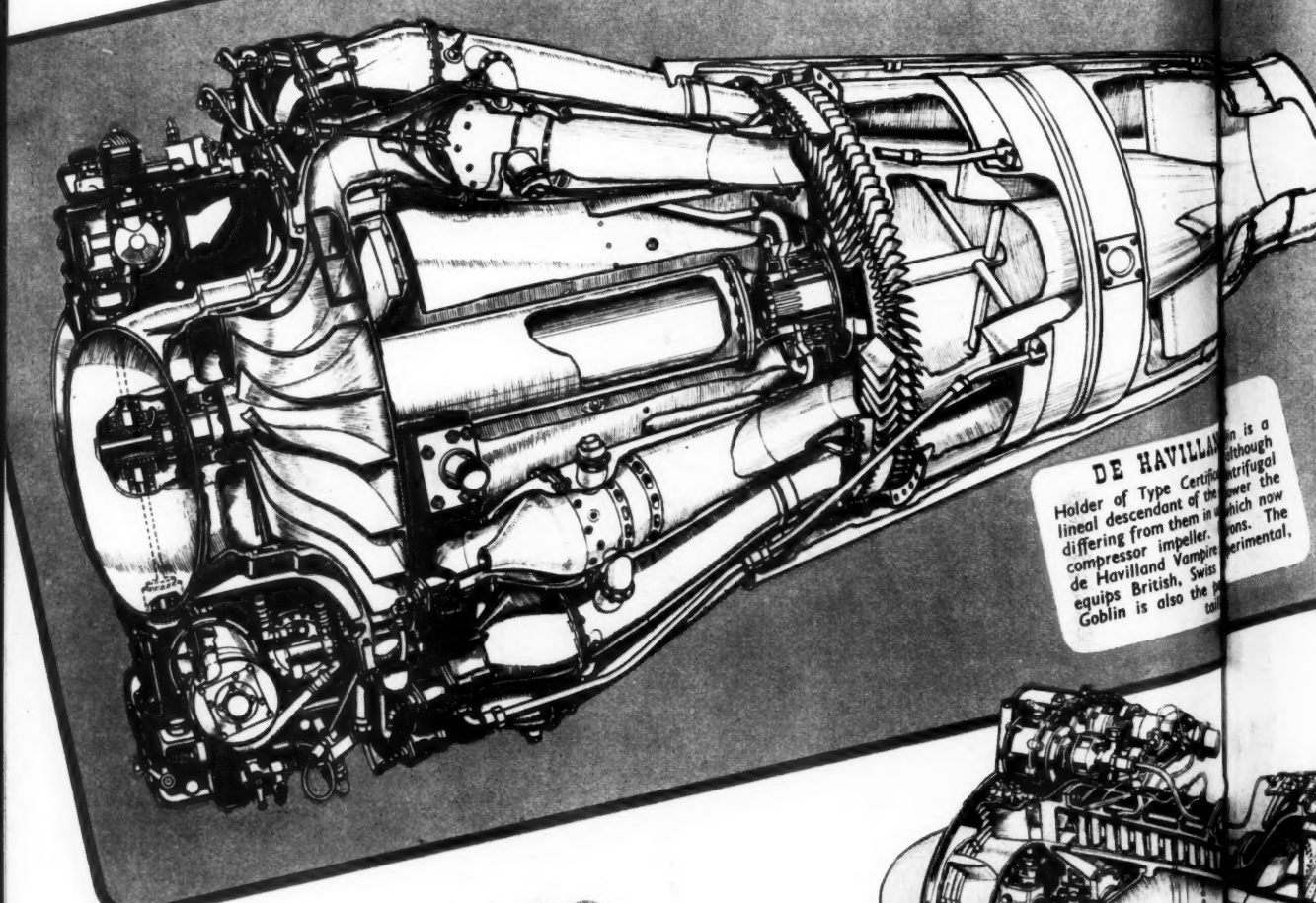
...h little has previously been said ... the fact, very considerable interest ... been shown abroad in the Avro XIX. ... understand that upwards of two ... are due for delivery outside this ... In its latest form the XIX—which ... passengers at a cruising speed ... m.p.h. over 610 miles—has all-metal wings.

Auster Autocrats have been exported in very large numbers during the past year, and are being used by owners and even by charter operators in various parts of the world. This aircraft was on its way to Uganda. The Autocrat carries three people at cruising speeds between 80 and 100 m.p.h.



De Havilland Vampire single-jet fighters have also been supplied in considerable numbers to the Swedish Air Force, the personnel of which are reported to be highly pleased with and proud of their 540-m.p.h. interceptors. The D.H. Goblin power unit is being built in Sweden.

Britain's POWER UNITS



DE HAVILLAND

Holder of Type Certific… lineal descendant of the … differing from them in … compressor impeller. … de Havilland Vampire … equips British, Swiss … Goblin is also the p… tai…

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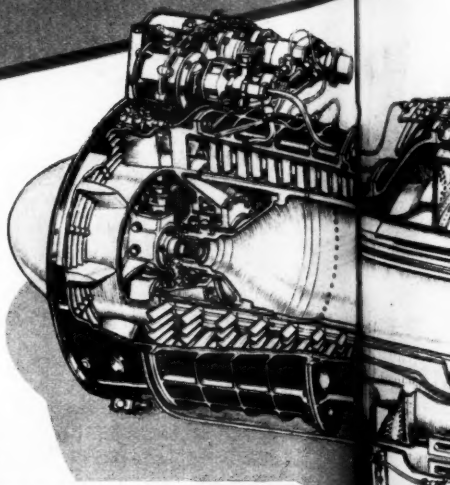

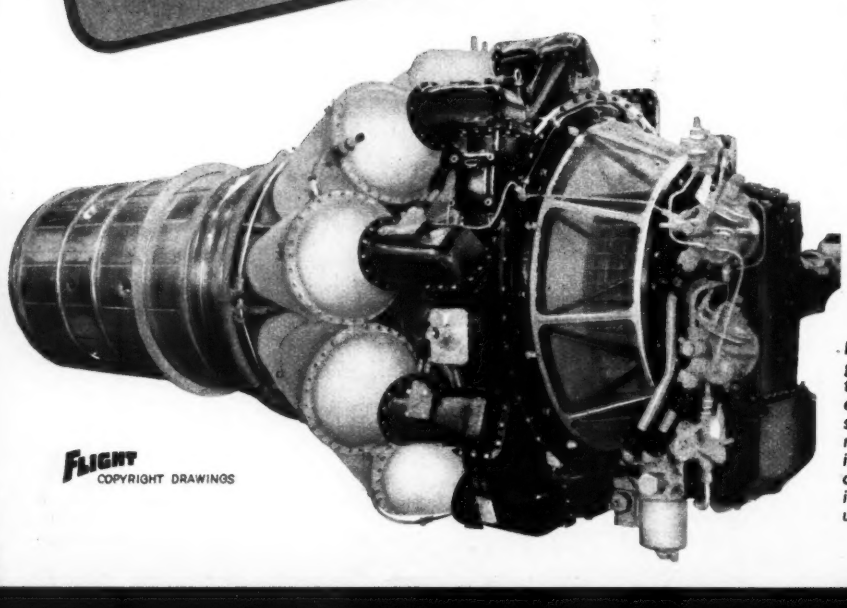

ROLLS-ROYCE NENE

Largest in the River class of Rolls-Royce gas turbine power units, the Nene is the world's most powerful aircraft engine in production. It is, in effect, a scaled-up version of its famous forerunner the Derwent V, but the increase in thrust up to 5,000 lb. (2,272 kg.) is disproportionately large for the increase in dimensions. The Nene is the power unit of the Vickers-Supermarine E.10/44, 600 m.p.h. (965 km./hr.) fighter.

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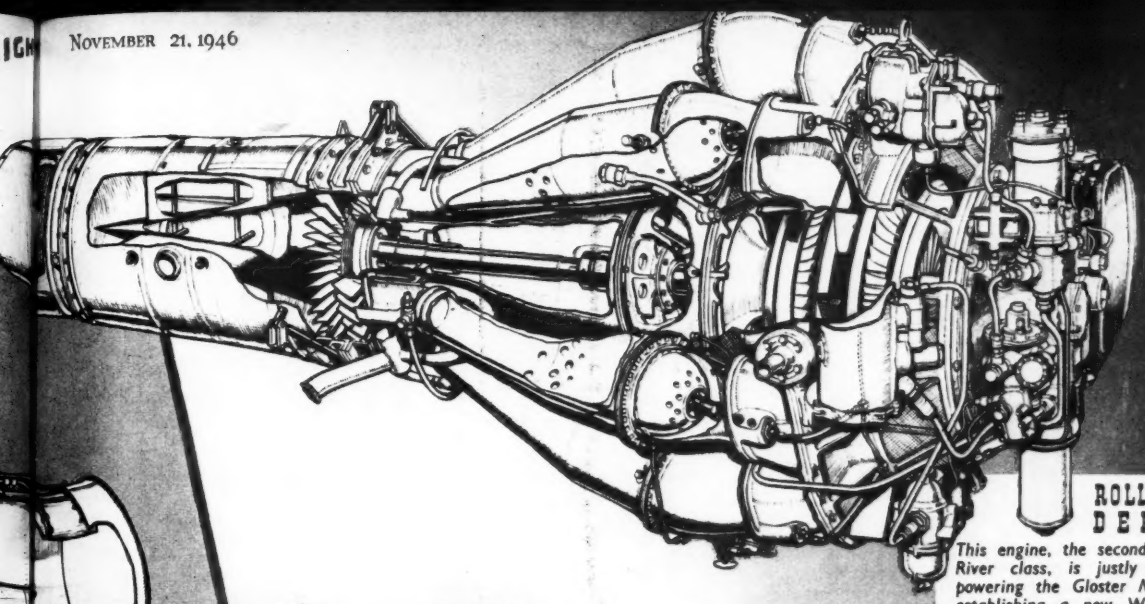
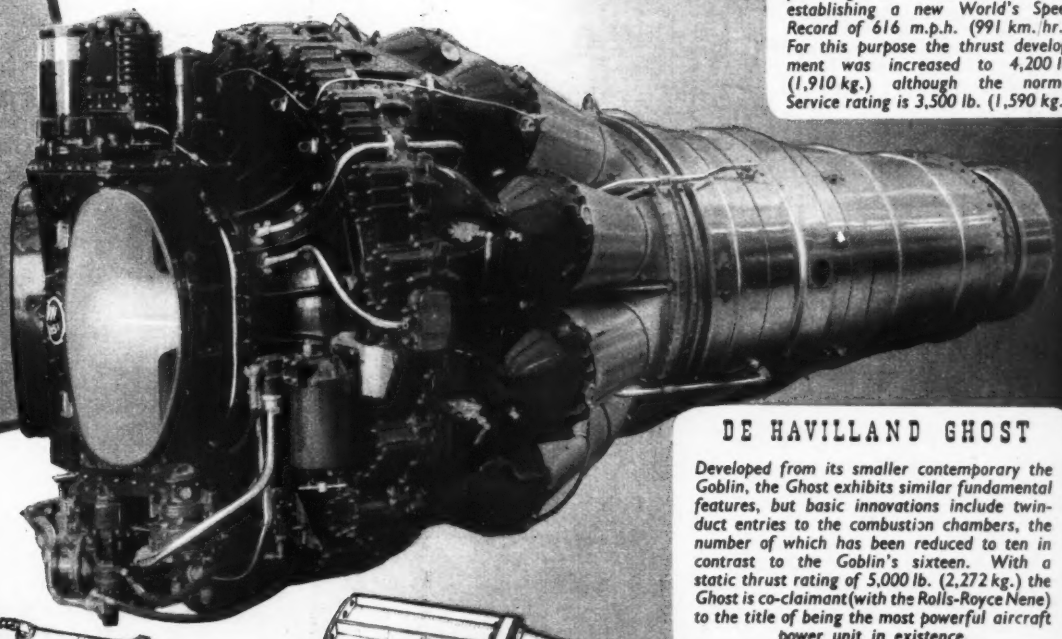


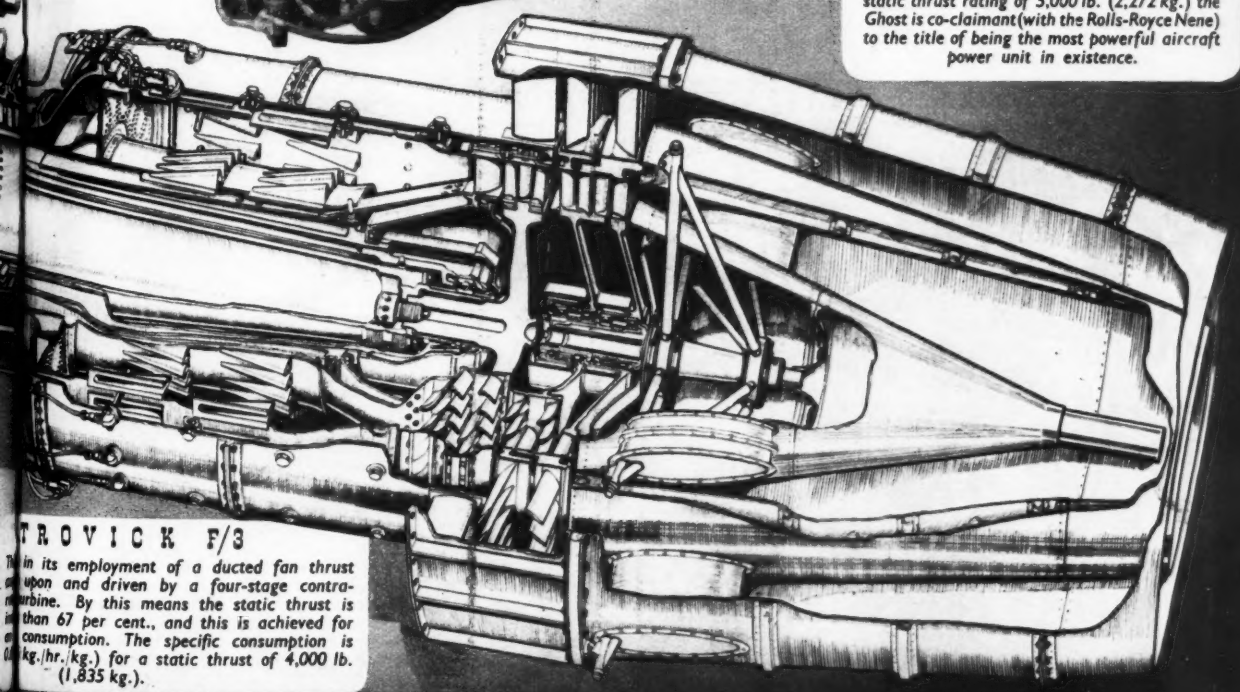
ROLLS-ROYCE DERWENT

This engine, the second in the R-R River class, is justly famous for powering the Gloster Meteor IV in establishing a new World's Speed Record of 616 m.p.h. (991 km./hr.). For this purpose the thrust development was increased to 4,200 lb. (1,910 kg.) although the normal Service rating is 3,500 lb. (1,590 kg.).



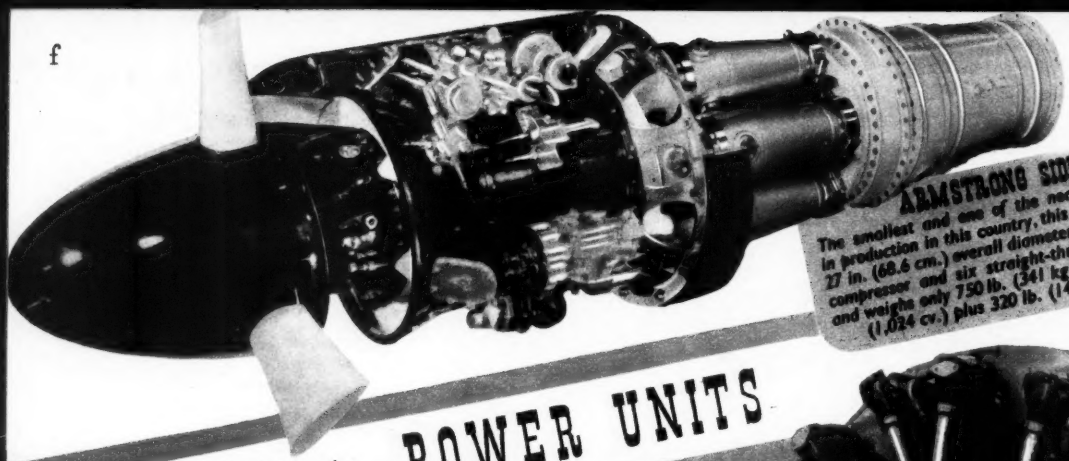
DE HAVILLAND GHOST

Developed from its smaller contemporary the Goblin, the Ghost exhibits similar fundamental features, but basic innovations include twin-duct entries to the combustion chambers, the number of which has been reduced to ten in contrast to the Goblin's sixteen. With a static thrust rating of 5,000 lb. (2,272 kg.) the Ghost is co-claimant (with the Rolls-Royce Nene) to the title of being the most powerful aircraft power unit in existence.



TROVICK F/3

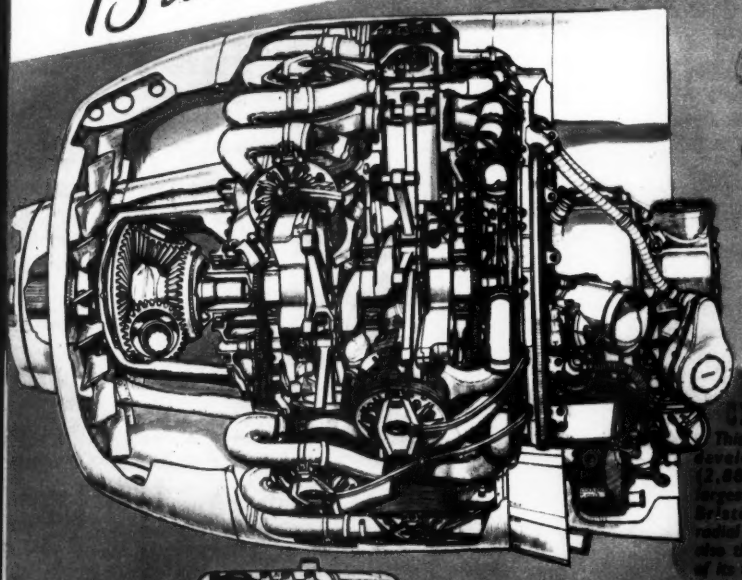
in its employment of a ducted fan thrust upon and driven by a four-stage contra-urbine. By this means the static thrust is than 67 per cent., and this is achieved for consumption. The specific consumption is kg./hr./kg.) for a static thrust of 4,000 lb. (1,835 kg.).



ARMSTRONG SIDDELEY MAMBA

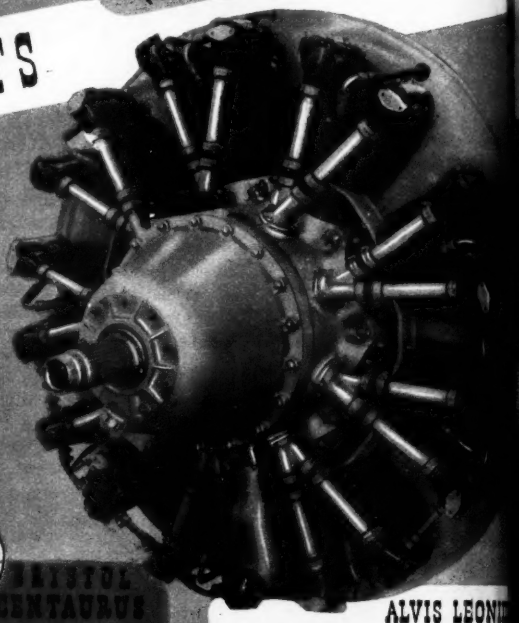
The smallest and one of the neatest airscrew/turbine in production in this country, this engine is remarkable 27 in. (68.6 cm.) overall diameter. It employs a 10-stage compressor and six straight-through combustion chambers and weighs only 750 lb. (341 kg.) for a rating of 1,000 h.p. (1,024 cv.) plus 320 lb. (145 kg.) residual jet thrust.

Britain's POWER UNITS



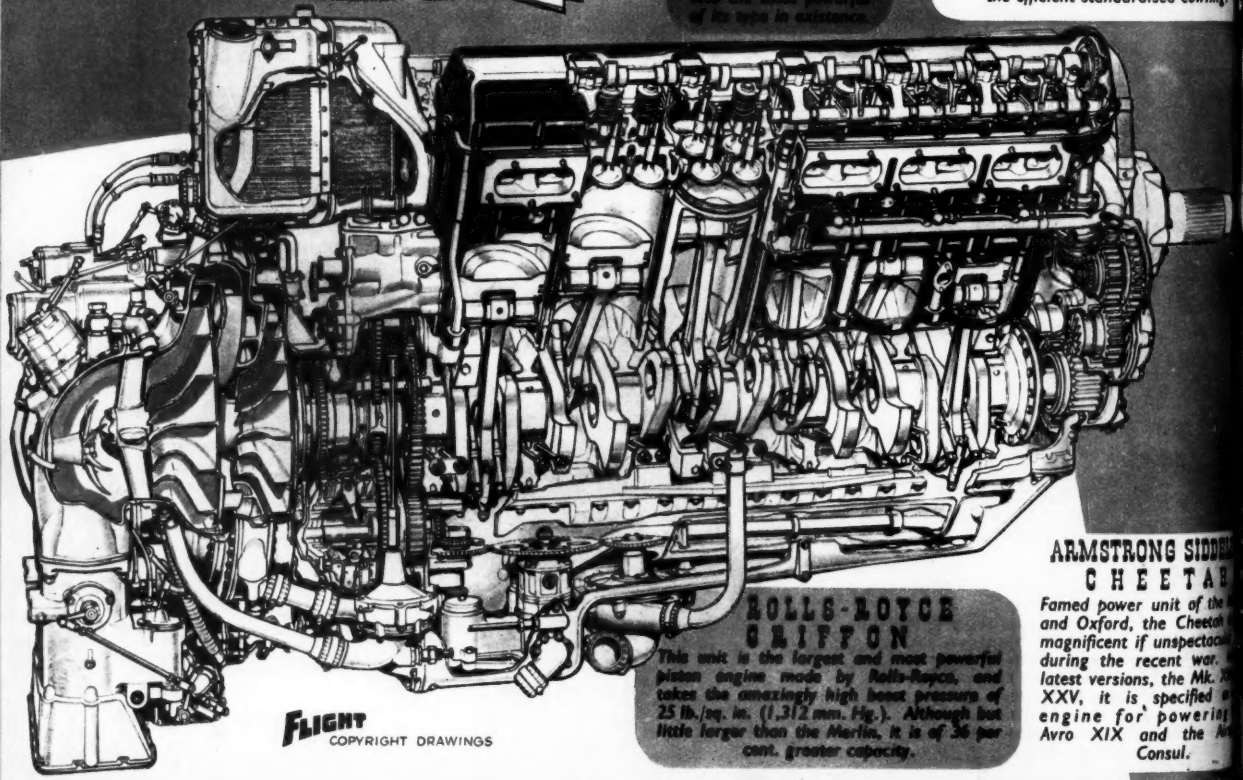
BRISTOL CENTAURUS

This engine, which develops 2,840 h.p. (2,882 cv.), is the largest of the classic Bristol sleeve-valve radial family, and is also the most powerful of its type in existence.



ALVIS LEONI

A very neat example of supercharg air-cooled radial practice in the medi power field, this 515 h.p. (522 cv.) is designed as a complete power pl with full auxiliaries housed neatly wit the efficient standardised cowling.



ROLLS-ROYCE GRIFFON

This unit is the largest and most powerful piston engine made by Rolls-Royce, and takes the amazingly high boost pressure of 25 lb./sq. in. (1,312 mm. Hg.). Although but little larger than the Merlin, it is of 36 per cent. greater capacity.

ARMSTRONG SIDDEL CHEETAH

Famed power unit of the and Oxford, the Cheetah magnificent if unspectacul during the recent war. latest versions, the Mk. XXV, it is specified engine for poweri Avro XIX and the Consul.

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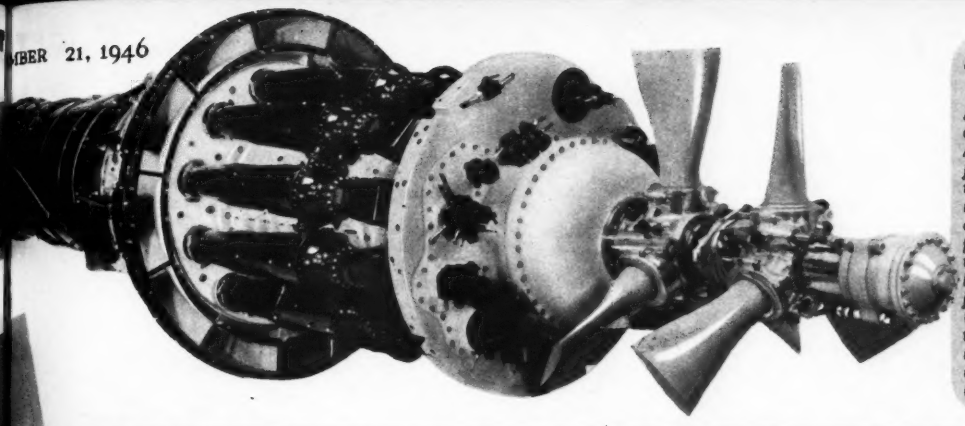
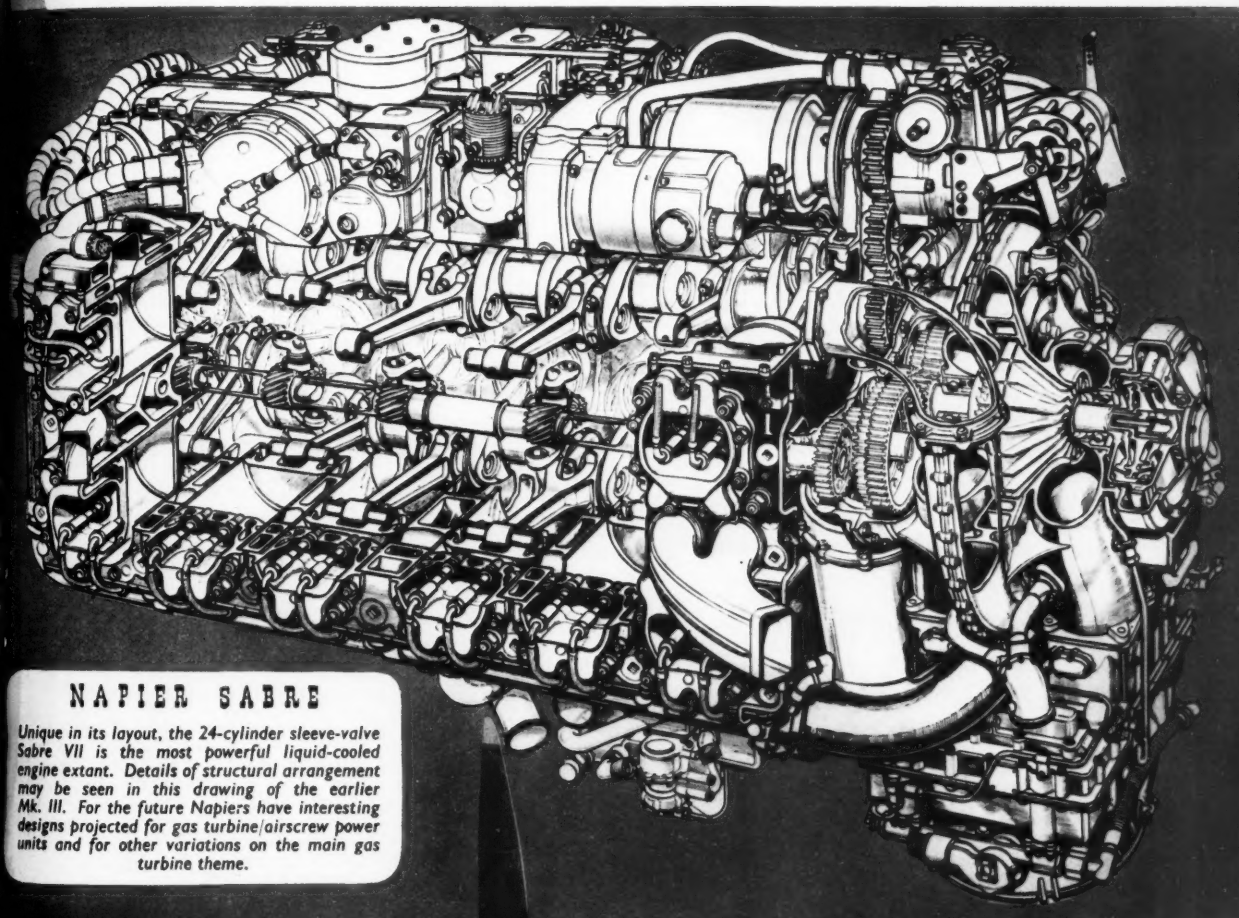


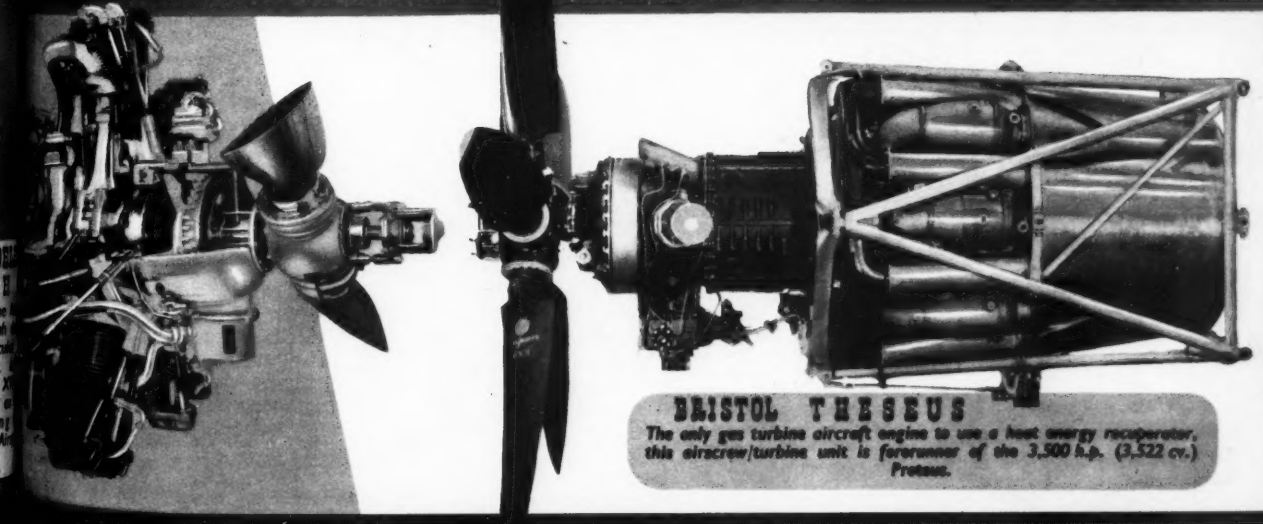
ARMSTRONG SIDDELEY PYTHON

An airscrew-driving descendant of the early Armstrong-Siddeley A.S.X. axial-flow gas-turbine jet unit, the Python is designed to accommodate contra-rotating airscrews capable of absorbing 3,670 shaft horse power (3,722 cv.) for take-off, this power being supplemented by 1,150 lb. (523 kg.) residual jet thrust. At the 500 m.p.h. (809 km./hr.) combat rating these values are changed respectively to 5,520 s.h.p. (5,600 cv.) and 280 lb. (127.3 kg.) residual thrust.



NAPIER SABRE

Unique in its layout, the 24-cylinder sleeve-valve Sabre VII is the most powerful liquid-cooled engine extant. Details of structural arrangement may be seen in this drawing of the earlier Mk. III. For the future Napiers have interesting designs projected for gas turbine/airscrew power units and for other variations on the main gas turbine theme.

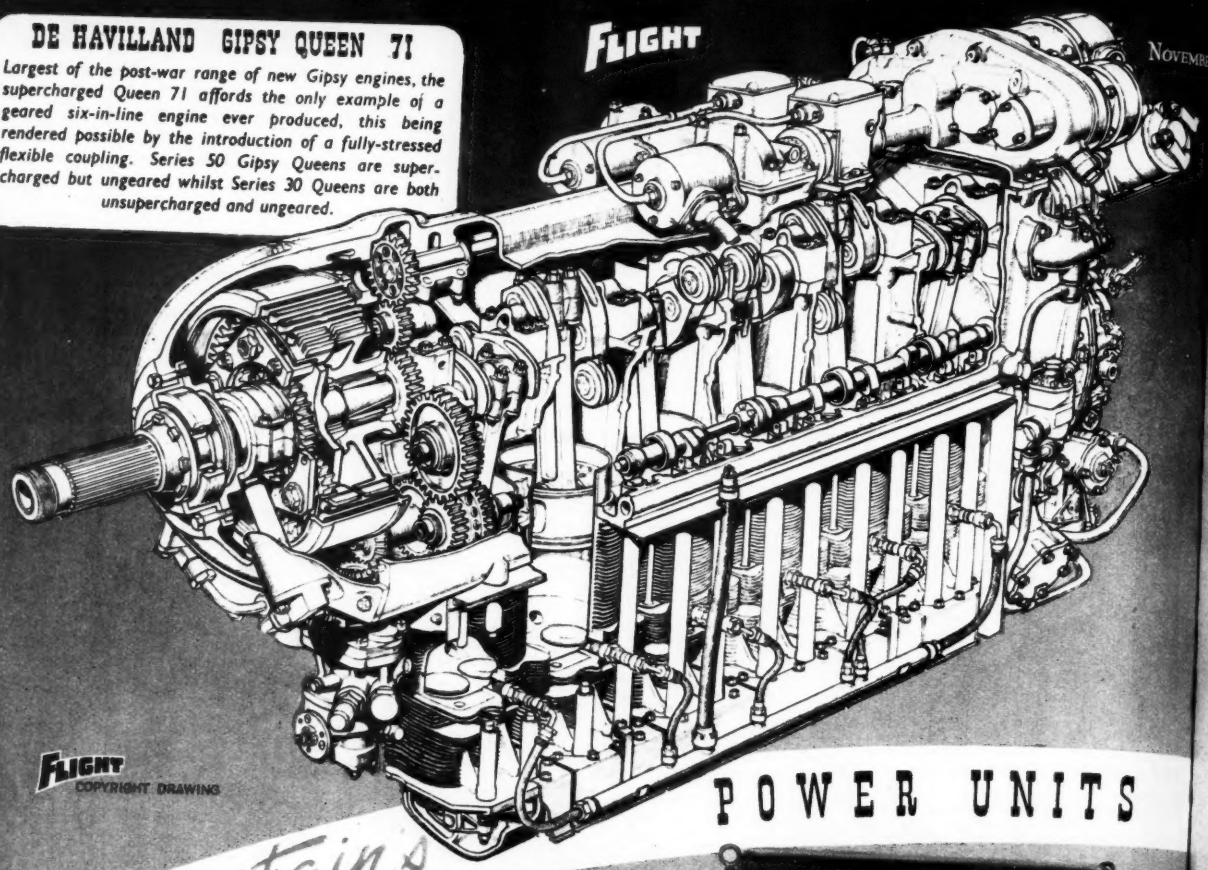


BRISTOL THESEUS

The only gas turbine aircraft engine to use a heat energy recuperator, this airscrew/turbine unit is forerunner of the 3,500 h.p. (3,522 cv.) Proteus.

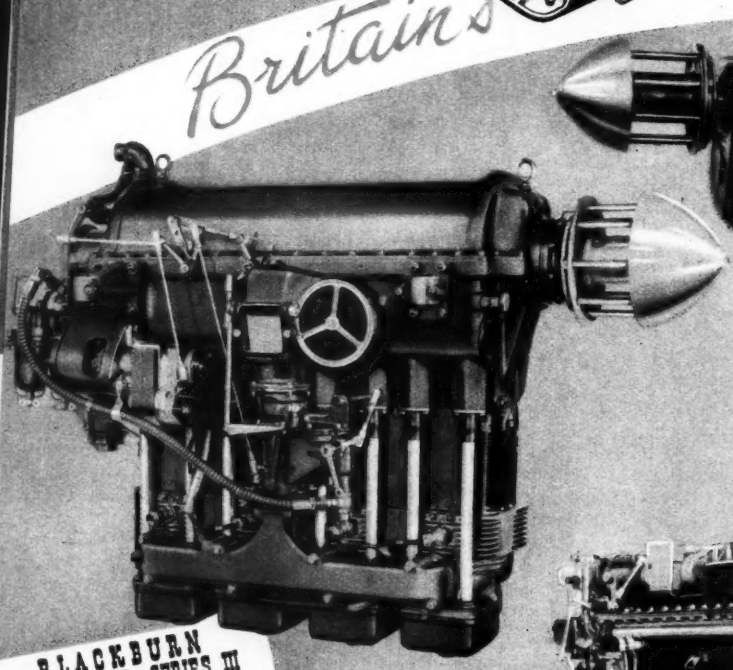
DE HAVILLAND GIPSY QUEEN 71

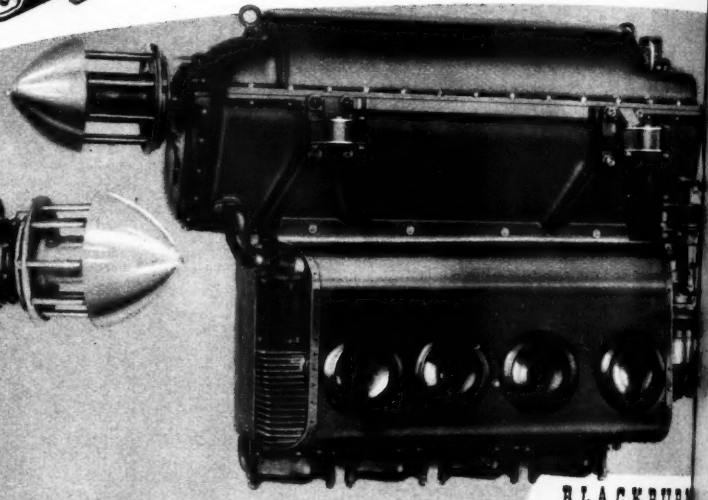
Largest of the post-war range of new Gipsy engines, the supercharged Queen 71 affords the only example of a geared six-in-line engine ever produced, this being rendered possible by the introduction of a fully-stressed flexible coupling. Series 50 Gipsy Queens are supercharged but ungeared whilst Series 30 Queens are both unsupercharged and ungeared.

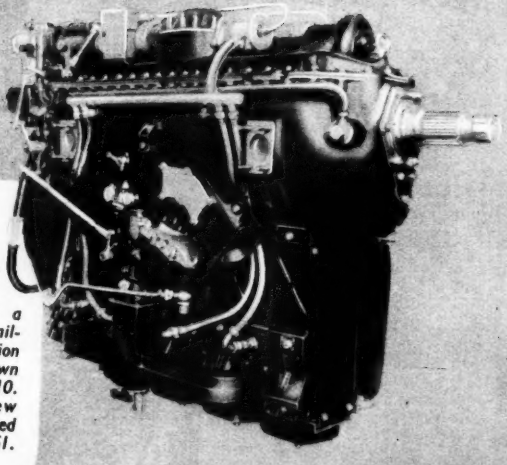


FLIGHT COPYRIGHT DRAWING

Britain's POWER UNITS







BLACKBURN CIRRUS MAJOR SERIES III

This robust and workmanlike four cylinder unit heads the post-war range of Cirrus light aircraft engines which, carrying on the tradition of excellence laid down by their predecessors, are being specified for many of our latest small aircraft.

DE HAVILLAND GIPSY MAJOR 31

Of the post-war range of new D.H. engines this is the smallest, although a lower powered unit is available in a modified version of the pre-war Major known now as the Gipsy Major 10. Additionally, the new Major 31 in supercharged form is called the Major 51.

BLACKBURN CIRRUS MINOR SERIES

A smaller brother of Major III, this four-engine is, without do among the finest of power class in the wo It has in common w the other Cirrus engi the quality of excell economy, and on score alone is very w fitted for club and pri owner use. The deve ment of two larger Ci engines of 180 h.p. 300 h.p. output recently been announ

PRINCIPAL DATA OF BRITISH POWER UNITS

PISTON ENGINES

Maker's Name and Engine Type	No. and Arrangement of Cylinders	Cooling	Bore × Stroke in	Capacity litres	Reduction Gear Ratio	Max. Power Rating				Recommended Economical Cruising Power				Take-Off Power	Fuel Consumption R.E.C.P. G.P.H.	Dry Weight (lb)	Notes
						b.h.p.	r.p.m.	Boost lb/sq in	ht. (ft)	b.h.p.	r.p.m.	Boost lb/sq in	ht. (ft)				
Alvis																	
Leonides ...	9 R	A	4.80 × 4.41	11.78	0.5 : 1 0.615 : 1	515	3,000	6.5	5,000	340	2,600	0	11,000	505	21	742	
Armstrong Siddeley																	
Cheetah 15 and 25.	7 R	A	5.25 × 5.5	13.67	0.732 : 1	405	2,425	2.75	4,000	260	2,100	0	S.L.	420 475	15.8	805	Cheetah 25 has high T.O. power. Max. W.M. consmptes. for R.E.C.P.
Blackburn																	
Cirrus Minor II	4 IL	A	3.93 × 4.99	3.99	Drct.	100	2,600	—	S.L.	80	2,200	—	S.L.	100	4.9	234	
Cirrus Major III	4 IL	A	4.72 × 5.51	6.33	Drct.	155	2,450	—	S.L.	125	2,100	—	S.L.	145	8.0	333	
Bristol																	
Hercules 101 ...	14 R	A	5.75 × 6.5	38.7	0.444 : 1	M.S.1,800 F.S.1,625	2,800 2,800	8.25 8.25	9,000 19,500	M.S.1,215 F.S.1,125	2,400 2,400	2.5 2.5	12,250 21,000	1,675	72 71	2,045	R.E.C.P. for all these units is Max. W.M. 2-speed.
Hercules 120 ...	14 R	A	5.75 × 6.5	38.7	0.444 : 1	M.S.1,800 F.S.1,465	2,800 2,800	7.5 7.5	6,000 23,000	M.S.1,230 F.S.1,090	2,400 2,400	2 2	10,750 10,750	1,715	71 72	2,025	Aux. drive suitable for cabin blower. High cruising altitude.
Hercules 630 ...	14 R	A	5.75 × 6.5	38.7	0.444 : 1	1,795	2,800	7.5	7,250	1,330	2,400	3.25	9,250	1,690	77	1,905	Moderate altitude civil engine. (R.E.C.P. for Wayfarer a/c special case).
Hercules 230 and 730.	14 R	A	5.75 × 6.5	38.7	0.444 : 1	2,055	2,800	12.0	3,500	1,305	2,400	3.5	11,500	2,000	75	2,060	Military Unit 230 Civil 730.
Centaurus XVIII, 57, 58 and 59	18 R	A	5.75 × 7.0	53.6	0.444 : 1	M.S. 2,840	2,700	11.5	750	M.S.1,790	2,400	2.5	11,800	2,825	105	2,870	Water/Methanol for T.O. and max. power quoted.
						F.S.2,610	2,700	11.5	14,250	F.S.1,640	2,400	2.5	21,500		102	2,780 2,790 2,870	
De Havilland																	
Gipsy Queen 30	6 IL	A	4.74 × 5.906	10.18	Drct.	250	2,500	—	S.L.	180	2,100	−2	3,500	250	12	510	
Gipsy Queen 50	6 IL	A	4.74 × 5.906	10.18	Drct.	270	2,400	—	7,000	180	2,100	−1	12,000	295	11½	560	Supercharged.
Gipsy Queen 70	6 IL	A	4.74 × 5.906	10.18	0.711 : 1	305	2,700	—	6,000	265	2,400	+2	7,750	330	17½	660	Supercharged.
Gipsy Major 10	4 IL	A	4.64 × 5.51	6.12	Drct.	145	2,550	—	S.L.	115	2,300	−2	5,000	145	8	312	
Gipsy Major 30	4 IL	A	4.74 × 5.906	6.78	Drct.	160	2,500	—	S.L.	118	2,100	−2	3,500	160	7½	340	
Gipsy Major 50	4 IL	A	4.74 × 5.906	6.78	Drct.	180	2,400	—	7,000	120	2,100	−1	11,500	197	8	410	Supercharged.
Fedden ...	6 HO	A	4.3 × 3.75	5.35	Drct. geared	160 185	2,750 3,400	— —	S.L. S.L.	— —	— —	— —	— —	160 185	— —	310	Rated power quoted. Bare, dry weight.
Monaco ...	4 HO Flat	A	4.375 × 3.625	3.6	Drct.	100	2,800	—	S.L.	85	2,420	—	S.L.	100	5.42	230	
Napier																	
Sabre VA ...	24 H horiz.	L	5.0 × 4.75	36.7	0.274 : 1	M.S.2,615	3,850	15	2,500	890	2,500	+½	11,500	2,310	56.7	2,490	Military power unit. Best specific consumpt. Single lever control quoted. MK.VII with water/methanol.
Sabre VII ...	24 H horiz.	L	5.0 × 4.75	36.7	0.274 : 1	M.S.3,055 F.S.2,760	3,850 3,850	17½ 17½	2,250 12,500	900	2,500	+½	11,750	3,000	55.7	2,540	
Rolls-Royce																	
Merlin 140 ...	12 V	L	5.4 × 6.0	27	0.521 : 1	M.S.1,780 F.S.1,650	3,000 3,000	20 20	4,500 16,750	M.S.1,200 F.S.1,185	2,650 2,850	9 9	10,250 23,750	1,725	75 89	1,780	2-speed. 2-stage
Merlin 500 ...	12 V	L	5.4 × 6.0	27	0.420 : 1	M.S.1,635 F.S.1,510	3,000 3,000	18 18	2,250 9,250	M.S.1,080 F.S.1,015	2,650 2,650	7 7	8,750 15,500	1,610	66 63	1,525	2-speed, 1-stage. Designed for continuous running at high boost. Makers quote Max. cont. cruising power for R.E.C.P. conditions.
Merlin 600, 620, 621.	12 V	L	5.4 × 6.0	27	0.420 : 1 0.470 : 1	M.S.1,770 F.S.1,655	3,000 3,000	20 20	4,000 16,500	M.S.1,175 F.S.1,160	2,650 2,850	9 9	10,000 23,500	1,725	73 83	1,700 1,746	2-speed. 2-stage
Griffon 37 ...	12 V	L	6.0 × 6.6	36.7	0.510 : 1	M.S.1,990 F.S.1,520	2,750 2,750	18 18	2,000 19,000	M.S.1,285 F.S.1,210	2,400 2,400	7 7	8,750 15,250	1,960	85 89	1,930	2-speed. 1-stage.
Griffon 67 ...	12 V	L	6.0 × 6.6	36.7	—	M.S.2,375 F.S.2,140	2,750 2,750	25 25	1,250 1,250	M.S.1,305 F.S.1,215	2,400 2,400	7 7	12,250 25,000	—	85 91	1,980	2-speed. 2-stage.
Griffon 74 ...	12 V	L	6.0 × 6.6	36.7	0.451 : 1	M.S.2,045 F.S.2,245	2,750 2,750	18 25	S.L. 9,250	M.S.1,310 F.S.1,250	2,400 2,400	7 7	7,500 19,000	2,020	87 94	2,100	2-speed. 2-stage.
Griffon 88 ...	12 V	L	6.0 × 6.6	36.7	0.442 : 1	M.S.1,235 F.S.2,120	2,250 2,750	25 25	1,250 15,750	M.S.1,305 F.S.1,215	2,400 2,400	7 7	12,250 2,500	1,935	85 91	2,210	2-speed. 2-stage. Contra-rotating airscrews.
Griffon 130 ...	12 V	L	6.0 × 6.6	36.7	0.442 : 1	L.S.2,420 M.S.2,250 F.S.2,050	2,750 2,750 2,750	25 25 25	5,000 14,500 21,000	L.S.1,320 M.S.1,260 F.S.1,150	2,400 2,400 2,400	7 7 7	15,500 22,750 30,500	2,000	90 95 96	2,100	3-speed. 2-stage. Contra-rotating airscrews.

On the following page will be found another table relating to British gas turbines together with comment on some new engines which are now undergoing development.

GAS TURBINE POWER UNITS

Maker's Name and Engine Type	Type of Compressor	No. of Combustion Chambers	Max. Power Rating (Sea Level Static)			Recommended Economical Cruising Power (R.E.C.P.)				Fuel Consumption (R.E.C P.)	Diam. and Length	Dry Weight	Notes.
			Thrust lb.	Shaft h.p.	r.p.m.	Thrust lb.	Shaft h.p.	r.p.m.	Speed (m.p.h.) and Ht.	G.P.H.	in.	lb.	
Armstrong Siddeley :													
Python	IA	11	1,150	3,670	8,000	950	2,720	7,600	S.L. Static	290	48×102	2,980	With intakes but not airscrews. Length from rear.
Mamba	IA	6	320	1,010	14,500	265	747	13,750	S.L. Static	79	42×81	750	Face of airscrew hub to rear face of turbine housing.
Bristol :													
Theseus	IA, IC	8	500	1,950	8,200	300	1,200	8,200	300 at 20,000	94	48×106	2,310	Weight includes intakes, heat exchanger and mounting.
de Havilland :													
Goblin II	IC	16	3,000	—	10,200	1,920	—	8,700	S.L. Static	290	49.85×100.5	1,550	Weight including tail pipe, nozzle, etc.
Ghost	IC	10	5,000	—	—	—	—	—	S.L. Static	—	53×127.15	2,011	
Metropolitan-Vickers :													
F.2/4	IA	1 Ann.	3,500	—	7,700	3,000	—	7,300	S.L. Static	385	37.25×161	1,785	
F.3	IA	1 Ann.	4,600	—	7,390	3,900	—	—	S.L. Static	319	46×140	2,300	Figures for ducted fan, thrust augmented unit.
Rolls-Royce :													
Derwent V	IC	9	3,500	—	14,700	3,000	—	14,100	S.L. Static	384	43×83.1	1,250	
Nene I	IC	9	5,000	—	12,300	4,500	—	12,000	S.L. Static	596	49.5×97	1,600	
Clyde	IA, IC	9	1,225	3,020	6,000	—	—	—	—	—	46.72× 121.2	2,800	Weight less airscrew.

IN the tables of engine data on pp. 567 and 568 an attempt has been made to present representative figures which will be useful as a guide to the operator and technician, and which will also offer instructive information and comparisons for the less technical reader. In that many of the power units are designed for a specific purpose, it would be necessary to quote more conditions, and in some cases the actual installation, if a true basis for comparison was desired. However, the use of Recommended Economic Cruising Power conditions (R.E.C.P.) enables the manufacturers to state the normal operating conditions which suit their product best. Thus, in some cases, R.E.C.P. equals maximum continuous weak mixture cruising, and in others the maximum power for continuous operation. Any particular qualifications are mentioned in the final "notes" column.

New Turbine Projects

There are several other British power units known to be under development which are not shown in the data table as insufficient figures have been released to justify their inclusion. Among such units is the Bristol Proteus which follows the Theseus airscrew-turbine and has been designed to produce 3,500 h.p. Examples of this motor are to be fitted in the Brabazon I No. 2.

In *Flight* last week, and earlier, another airscrew-turbine was briefly described; this was the Fedden 1,350 h.p. axial flow unit. At full r.p.m. at sea-level static conditions its total power is made up of 1,305 shaft h.p. and 120 jet equivalent h.p. The airscrews speed for these conditions is 1,217 r.p.m., and additional figures are weight 750lb, diameter 27in, and length 59.5in.

The Metropolitan-Vickers company announce a new unit, the F5. To be more precise the new scheme called the F5 open fan augmenter is a development of the F3 ducted fan, the fan blades becoming, in effect, short airscrew blades with an overall diameter of 5ft 6in. In the case of the F3 the augmenter intake is fully ducted and the large passages may present some difficulties with regard to accommodation. The contra-rotating pusher fans of the F5 arrangement are driven by a four-stage turbine on the same lines as the F3, and at a speed of 2,600 r.p.m. they absorb 2,300 shaft h.p. The weight of the complete augmenter unit is 600lb which is less than half that of a normal airscrew for the same power. The gas generator portion, which is part of the standard F2 series 4A engine weighs 1,600lb, and the hot gas ducting between the two parts weighs 15lb per ft. The total weight of the installation is therefore approximately 2,250lb. Performance figures are as follows:—

Flight Condition	Fan	Thrust Jet	Total	Augmentation Ratio	Specific Fuel Consumption
Take off 75 m.p.h. Sea Level ...	2,840	1,870	4,710	1.43	—
Climb 200 m.p.h. 20,000 ft	1,850	850	2,700	1.56	0.663
Continuous Cruising 400 m.p.h. 20,000ft	1,670	630	2,300	1.48	0.872

A new Rolls-Royce airscrew-turbine with axial-flow compressor has been named the Dart. This unit, four of which have been earmarked to power the Vickers VC-2, is in the same class as the 1,100 h.p. Armstrong Siddeley Mamba.

The Napier Company are known to be developing various gas turbine designs, at least one of which will be of the airscrew-driving type.

Among the small power units at least six have been described or briefly mentioned in *Flight* during the last few months. Last week details were given of the 100 h.p. Nuffield flat four and of the 185 h.p. Fedden flat six. Previously, the 110 h.p. Jamieson, also a horizontally-opposed four cylinder unit, was described in detail, and the recent Blackburn Cirrus announcement of a new series in the 150-300 h.p. class to be called the Bombadier, Musketeer and Grenadier was recorded.

It can be assumed that this country is well aware of the possibilities of rocket motors and that research and development is in progress. In fact, a bi-fuel liquid rocket based on German designs and intended for installation in the Vickers transonic research aircraft has been described.

FORTHCOMING EVENTS

Nov. 21st.—R.Ae.S., London (Graduate and Student Section); "Structures in Aircraft Design," R. H. Sandifer (Handley Page Ltd.), 7.30 p.m.

Nov. 21st.—R.Ae.S., Glasgow Branch; "Experiences of a Test Pilot." P. W. S. Bulman, Prestwick Airport, 7.30 p.m.

Nov. 22nd.—Institute of Physics (Sheffield); "The Spectrographic Analysis of High Purity Metals." D. M. Smith, The University, St. George's Sq., 2.15 p.m.

Nov. 26th.—Society of Instrument Technology; "Aircraft Instrumentation in Test Flying." C. N. Jaques, Manson House, 26 Portland Place, London, W.1.

Nov. 28th.—"Aeotech" Flying Club No. 1; "34 Years' Photography of Aircraft." John Yoxall (*Flight*). Fairey canteen, 8 p.m.

Nov. 29th.—Institution of Mechanical Engineers; "Aircraft Propulsion." F. M. Green and J. M. Wallington.

Nov. 30th.—Grand Pathfinder Dance, New Royal Horticultural Hall, Westminster, 7.30 p.m.

ENGINES AT THE PARIS SHOW

British Industry's Great Lead : Many Foreign Projects, But Few Actual Achievements

THE photogravure supplement of this issue is largely devoted to the power plants available from British manufacturers. At the Paris Show they occupy a prominent place, and by general consent they are far ahead of anything so far produced by any other country. The supplement, and the table of data which follows it, give the essential features of British piston and gas-turbine engines, and in next week's issue we shall deal with them from the exhibition aspect. In the following pages we describe the foreign power plants seen at the Grand Palais.

French Gas Turbines

Although the French aircraft designers are obviously jet conscious, the engine manufacturers are, as yet, unable to supply them with a single gas-turbine power unit. As already mentioned, Hispano-Suiza have obtained a licence to build Rolls-Royce Nenes, and these powerful and excellent British units are specified for a number of prototype aircraft. A few captured German Jumo 004 turbo jets are also being installed as an interim measure.

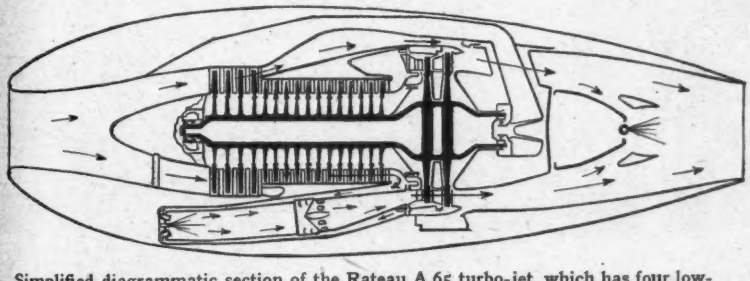
A very large all-French axial-flow turbo-jet is projected by the firm Turbomeca. So far, beyond the design on paper, some development work has been done on the annular combustion chamber and on the axial compressor, taking one stage at a time in a specially-designed wind tunnel. The designed sea-level thrust is as high as 15,400 lb, and the weight is estimated at around 9,000 lb. The axial compressor has eight stages and the turbine two. We are told that the overall diameter is to be 5ft 3in and the length 18ft.

More interesting, in that a prototype has been constructed and is actually displayed, is the Rateau A.65 turbo-jet. The company has had long experience of compressors, turbo-superchargers, etc., and should be well qualified to enter the gas turbine field. Their A.65 has an axial compressor with four low-pressure stages and 12 high-pressure stages of compression. The nine combustion chambers are grouped round the compressor casing, and are of the reverse flow type feeding rearwards into the two-stage turbine. A portion of the air from the low-pressure stages of compression is by-passed to the tail pipe at a point level with the cone behind the turbine. Here extra fuel can be injected to give after-burning.

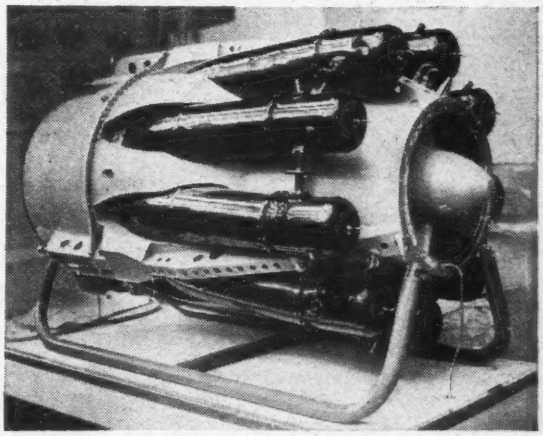
Design was begun in 1939, continued "under cover" during 1942 and 1943, and construction took place during 1945 and 1946. Present data for the engine which is now under development and has not yet run at full power are given as follows: Static thrust at sea level and 7,500 r.p.m. 1,760 lb, or with after-burning, 1,985 lb; weight 2,645 lb.

French Fiston Engines

Among the French aircraft engine manufacturers at Paris appear a number of new names, and among the products bearing them may be found some striking designs. Two Arsenal Units, the 24H and double 24H, though obsolete in conception, are noteworthy. The 24 is of vertical H arrangement, having four banks of six cylinders and developing 4,000 h.p. Interesting features are the twin blowers, one of which feeds the upper banks of cylinders, the other the lower through



Simplified diagrammatic section of the Rateau A.65 turbo-jet, which has four low-pressure and 12 high-pressure stages of compression.



The Rateau A.65 has nine combustion chambers grouped around the compressor casing. Above is a half-front view.

long, curved trunk pipes. The blowers are driven by a common horizontal cross-shaft, one situated at each end. Either of the two crankshafts may be removed without disturbing the other section of the engine. Large plates on the sides of the common crankcase casting may be removed to expose the bearing caps which may be withdrawn sideways. A pair of these units coupled in tandem by a long shaft, and driving concentric airscrews, comprises the double-24 power unit of 8,000 h.p. A link-up of additional power units, adding 4,000 h.p. up to a total of 16,000 h.p., is seriously suggested.

Hispano-Suiza engines have retained their characteristic appearance, and the 12Z with petrol injection to individual cylinders—of which there are twelve in 60 deg. vee form—is a direct descendant of the familiar 12-cylinder pre-war units. The 24-cylinder vertical H with concentric airscrews does not seem to have altered appreciably since its introduction at the 1938 Paris Show. The twin fuel injection pumps for these engines are located on the outside of the banks of cylinders, and in the case of the 24Z four separate trunk pipes take air from the blowers to the upper and lower banks on their respective sides. Provision is made to carry the drive-shaft from a second engine between the upper banks of cylinders. Power figures are 3,600 h.p. at 2,800 r.p.m. for the 24Z, and 1,800 h.p. at 2,600 r.p.m. for the 12Z.

An interesting and significant addition to the Hispano-Suiza range is the Nene turbo-jet built under licence from Rolls-Royce. No Nenes have been built as yet, nor are any likely to be completed for some months to come.

One of the only proven French power units in the higher-power class is the old familiar Gnome-Rhône 14R, which now gives 1,700 h.p. for take-off and, using F.S. gear, 1,225 h.p. at 22,000ft. Now known as the S.N.E.C.M.A. 14R this engine is of particular interest in view of its cowling and nacelle. For use on large flying boats and landplanes the installation has a power-operated hinged cowling which opens up into three portions. A fitter can climb up a short ladder through a door in the lower portion of the nacelle, behind the engine. He re-emerges from a trap door on the top of the cowling and steps forward on to the side panels of the cowling, which have folded down to form platforms on each side of the engine. The air-intake duct and filter, which are part of the lower folding panel, drop down some 12 to 18

ENGINES AT THE PARIS SHOW

inches to give access to the underside of the engine. A photograph taken at the exhibition appears below.

In the medium-power class of French engines is the S.N.E.C.M.A. (*Société Nationale d'Etude et de Constructions de Moteurs d'Aviation*) (Renault) 12S, an inverted 60-deg. V-12, air-cooled unit giving 580 h.p. at 3,300 r.p.m. for take-off and a maximum of 495 h.p. at 3,250 r.p.m. at 8,500ft for cruising. It is of 12 litres capacity and weighs 1,120 lb. The smaller units of the S.N.E.C.M.A. series are inverted in-line types. The Renault 6.Q.20 gives 240 h.p. at 2,500 r.p.m. and the capacity and weight are 9.49 litres and 557 lb respectively.

Three rather smaller Regniers, the 4.LO, 4.KO and 4.JO, give 150, 100 and 75 h.p. at 2,400 r.p.m. and have capacities and weights of 6.3, 4 and 2.925 litres and 288, 198 and 172 lb. respectively.

It is a characteristic of most series of light French engines that several major components, such as cylinders, pistons, valves and connecting rods, are interchangeable. Examples are the Potez with a standard bore and stroke of 125 and 120 mm, the Mathis, and the S.N.E.C.M.A. types just mentioned, with bores and strokes of 120 × 140 mm and 105 × 115 mm. Such standardization, following extensive experience with a single-cylinder development unit, undoubtedly has some advantages from the production and cost point of view, and is to be recommended for almost any but the higher-powered military engines.

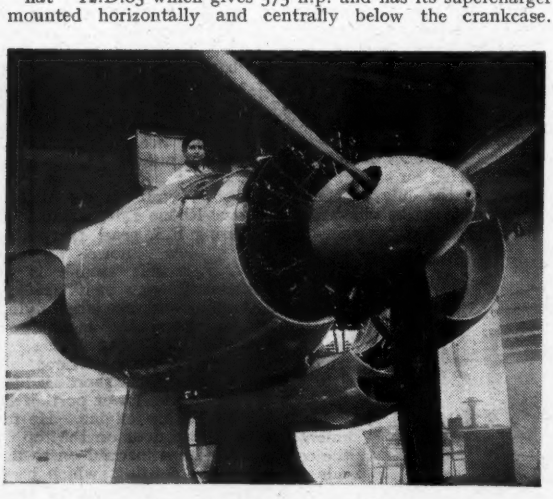
A great variety of air-cooled engines are produced by the Mathis company. Their characteristics are briefly as follows:

Type	Cyls.	h.p.	
G.2.F.	2.H.O.	40	Tested, in production.
G.2.R.	2.H.O.	50	Under development.
G.4.F.	4.H.O.	75	Undergoing type tests.
G.4.	4.I.L.	77	Tested, in production.
G.7.R.	7.R.	175	Tested, in production.
G.8.R.	8.I.V.	200	Tested, in production.
G.8.R.V.	8.I.V.	200	As above, with fan cooling of enclosed cylinders.
G.16.R.	16.X	400	Under development.
G.14.R.S.	14.2R	500	Under development.

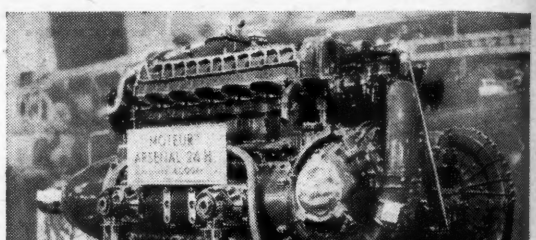
In addition to the above, variation of type exists in that the G.4, G.7 and G.8 may be supplied with or without reduction gear.

The X.16 is in effect a double engine in that, if a failure occurs in one cylinder bank, the pair of banks on the opposite side with separate crankshaft will continue to drive the airscrew via the reduction gear.

Another varied selection of air-cooled power units is shown by the Potez company, these being the 160 h.p. 4.D.01, an inverted four in-line; the 320 h.p. 8.D.10, an inverted vee-eight with reduction gear but no supercharger; the supercharged 425 h.p. 8.D.00 version of the above; and the "flat" 12.D.03 which gives 575 h.p. and has its supercharger mounted horizontally and centrally below the crankcase.



Power-operated cowlings form platforms on the Gnome-Rhone 14R now manufactured by the S.N.E.C.M.A. The fitter climbs through the nacelle behind the engine.



The Arsenal 24H is of vertical H arrangement. One blower supplies the upper cylinders, the other the lower.

There are, therefore, three basic types of air-cooled units which following a programme introduced in 1935, have been developed, officially type tested, and are in series production.

All these power units are based on an original single-cylinder research engine with bore and stroke of 125 × 120 mm, and a capacity of 1,475 litres.

During the period of occupation after 1940, the Potez experimental department was also concerned with two seven-bank 28-cylinder units giving respectively 1,800 and 4,000 h.p.

Engines that will be remembered from pre-war expositions are the Salmson range of radials. Those displayed are the 83 h.p. 5AP.01; the 103 h.p. 5AP.03; the 135 h.p. 9 N.C.; and the 230 h.p. 9A.B.C.

Inverted in-line engines for the medium, light, single and twin aircraft are displayed by Le Béarn (S.C.E.M.M.). The Béarn is a six-cylinder unit with supercharger and reduction gear. It delivers 390 h.p. for take-off and 350 h.p. maximum at 2,700 r.p.m. at 7,550 ft. The weight is 695 lb. A sectioned engine—the work of the pupils of the S.C.E.M.M. technical school—is also exhibited.

Marcel Bloch show a single, very neat, inverted, four in-line, supercharged unit known as the 4.B2. It has push rods on each side of the cylinders and a large square-edged sump below the auxiliary drive casing. It develops 220 h.p. for take-off.

The firm of Victor Minié show three small horizontally opposed "fours," known as the Horus 4.D4, 4.DA.25 and 4.DA.28. Of these the 25 gives 60 h.p. at 2,450 r.p.m. (it is made with a single or with twin carburettors), and the 28 gives 70 h.p. at 2,430 r.p.m. Unlike the other Horus types, the 4.D4, giving 70 h.p. at 2,450 r.p.m., has its four opposed cylinders cast in pairs as also are the heads. The top of the sump is unobstructed fin area, and the carburettor feeds through passages in the sump and via two short induction pipes to inlets between the cylinder barrels.

Under the heading of miscellaneous must be placed several interesting experimental and prototype power units. First, there are two diesel aero engines. An experimental 14 N.C. Gnome-Rhone conversion has pairs of injection pumps which are disposed radially around the rear of the reduction gear and each pair feeds its corresponding front and rear bank cylinders. At this early stage of development the unit has shown itself capable of running with very weak mixtures at altitude and at exceptionally low idling speeds in the region of 360 r.p.m. The maximum output is 1,100 h.p. and the weight 1,650 lb. An improvement of 15 per cent in specific consumption has also been achieved.

An entirely different engine, the Averseng, underwent development in Algeria during the occupation of France. It is a two-cylinder opposed design with four pistons, the two-pistons-per-cylinder barrel also being opposed. The power is 60 h.p. at 2,000 r.p.m. and the present weight, without cooling system, is 220 lb. The bore is 90 mm and the strokes are 110 and 80 mm for inner and outer pistons respectively. A cruising consumption of 0.44 lb/b.h.p./hr is quoted.

Another very novel design is a 2-stroke radial with six double cylinders. This is the Echard Lutetia which develops 70 h.p. at 2,600 r.p.m. for a weight of 132 lb.

The double air-cooled cylinders are connected by a passage in their common heads and the pistons are phased to give the optimum control of valve opening and expansion after com-

ENGINES AT THE PARIS SHOW

bustion. An induction fan directly driven and placed in a casing in front of the engine draws the mixture from the carburetter and feeds it to the front six-cylinder barrels.

American Engines

Presumably with an eye on the export market, American firms represented at Paris show well-tried production engines. Curtiss-Wright display a Cyclone 18, rated at 2,500 h.p. for take-off at 2,800 r.p.m., and a nine-cylinder Cyclone giving 800 h.p. at 2,600 r.p.m. for take-off. A feature of these engines which has created interest is the elaborate pressed cooling fins.

Pratt and Whitney have on their stand two fourteen cylinder Twin Wasps and a Double Wasp. R.1830s giving 1,200 h.p. for take-off are the power units of the Dakota. R.2000s with single-stage, two-speed superchargers, are the rather larger fourteen-cylinder units which are installed in the Skymaster. Finally, the R.2800 specified for the D.C.6, gives 2,100 h.p. for take-off or 2,400 h.p. with water injection.

Small engines from the United States are represented by the Continental C.85 and C.125. Their powers are indicated by their mark numbers, and both are air-cooled and horizontally opposed. The smaller unit is a "four," the larger a "six."

Czechoslovakia

Always prolific in small power units of all types, Czechoslovakia is represented by a group comprising products of the Praga, Walter and Zlinavion companies. Details are as follows:

Type	Cyls.	Horsepower
Praga B. 2	2 H.O.	45
Praga D	4 H.O.	75
Praga E	8 H.O.	150
Walter A	2 I.L.	22
Walter Mikron III	4 I.L.	65
Walter Minor 4-IIIs	4 I.L.	120
Walter Minor 6-IIII	6 I.L.	160
Zlinavion Persy 3	4 H.O.	65
Zlinavion Toma 4	4 I.L.	105
Zlinavion Toma 6	6 I.L.	165

The small Walter A is a 996 c.c. two-stroke giving 16 h.p. at 2,200 r.p.m. for cruising and a maximum of 22 h.p. at 2,500 r.p.m. The compression ratio is 6:1 and the weight 52 lb.

In addition to the small power units displayed, Czechoslovakia produces several higher-powered engines. These include the Avia R.K.17, a 420 h.p. nine-cylinder radial; the A.S.410 A-1, a 465 h.p. inverted 60-deg vee air-cooled type; and, formerly built under German licence, the war-proven 1,475 h.p. D.B.605 liquid-cooled inverted vee-twelve, and the 1,000 h.p. nine-cylinder radial Fafnir 323.

Rotating-Wing Aircraft

Particulars of Four Foreign Types Displayed

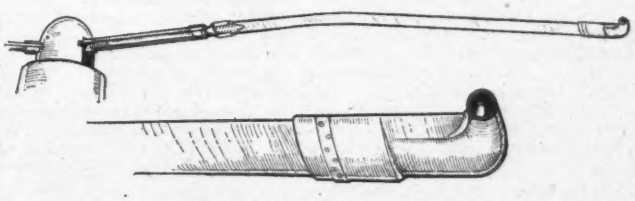
ROTATING-WING aircraft have an important part in the Grand Palais, in position if not in numbers.

Aerocentre have an NC.2001-2002, the Bee, which uses twin two-blade rotors laterally disposed and centred at a vertex angle of roughly 35 deg so that they "mesh" in rotation. Rotor blades are fabricated in light alloy and are feather-shaped in plan. The power is provided by a 450 h.p. Renault 12 S OO inverted V 12-cylinder air-cooled engine, the cooling air intake (and carburettor intake) being arranged in the rotor hub pedestals and exhausted from a gill-slot toward the tail.

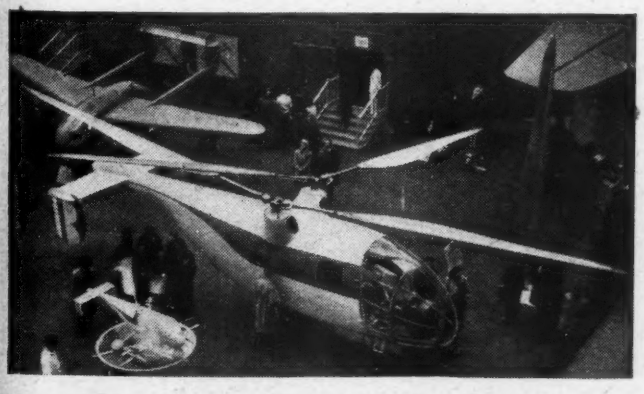
Seats for three passengers side by side are arranged behind the dual pilots' seats, and the machine is said to have been designed for taxi, ambulance, postal or rescue work. The main undercarriage wheels are carried on large cast light-alloy breaker struts which fold to retract the wheels into recesses in the fuselage sides. Tail surfaces are provided in the form of tailplane and elevator with end-plate inverted fins and rudders, which are purely for trimming purposes, normal manœuvring control being achieved in the usual cyclic pitch change fashion. Maximum design speed is 167 m.p.h., and cruising speed 135 m.p.h., with a range of 435 miles; the consumption is 10 gall/60 miles at maximum speed.

Bréguet has an interesting and useful-looking helicopter in the 11E which, seating three (two side by side at the back and the pilot centrally in front) employs co-axial two-blade contra-rotating rotors driven by a 240 h.p. nine-cylinder Potez 9E air-cooled radial engine placed behind the cabin. Cooling air is taken through louvres and exhausted by a gill-slot behind. A fixed tricycle undercarriage is used, and performance is quoted as: Max. horizontal speed, 150 m.p.h.; cruising speed at 9,500ft, 110 m.p.h.; ceiling, 13,000ft; and payload 880 lb. Successful tunnel tests have been carried out, and as soon as modified rotor blades are available (they are being made in Sweden) the aircraft will undergo its initial flight trials.

A curious-looking gyrodyne is shown on the S.N.C.A.S.O. stand—the S O 1100—which, because of its somewhat bright colour and dumpy shape, was at once christened the Orange Squash. It is purely an experimental effort and employs a three-blade single rotor which is jet-driven at 300 r.p.m. by tangential orifices at the tips, the fluid medium being the exhaust gases from a G.7 Mathis 170 h.p. engine. This unit also drives a three-blade fixed-pitch pusher propeller enclosed in a circumferential ring carried on what are, in effect, cruciform tailplane and fin surfaces. A rudder is employed behind the propeller and should, in that position, be very effective. One is inclined to wonder, however, at the possible vibratory troubles likely to be found in the arrangement of surfaces and propeller. It should be interesting to see how this aircraft performs when the first flight trials are made.



The three blades of the SO 1100 helicopter are driven by exhaust jets at the tip (shown inset).



The NC 2001 has intermeshing rotors and a retractable undercarriage. The designers hope for a speed of 167 m.p.h.

On the S.N.C.A.S.E. stand is a large twin-rotors-on-outriggers helicopter, which many visitors to the Palais will recognize as the Focke-Achgelis of pre-war German fame. Certainly it is the only helicopter exhibited which is known to work.

Perhaps the most significant design point of the rotating-wing types exhibited is that the extra complication of multiple rotors appears to find more favour with the Continental designers than does the anti-torque reaction tail rotor.

CIVIL AVIATION NEWS

Gatwick as Charter Centre:
G.C.A. for London:
Fido Possibilities

ONE OF MANY : The D.H. Dove is, as orders show, proving of considerable interest to airline and other operators abroad. Here is the first for Central African Airways. Other types for which useful export orders have been placed are pictured elsewhere.

DOMINION DEMAND

A Medium-size Transport Specification Suitable for Operations in Remoter Areas

IT is doubtful whether manufacturers in this or any other country have so far seriously considered the possibilities of producing an aircraft expressly for Dominion and Colonial feeder-line use. With the steady increase in transport aircraft efficiency, the needs of these operators seem to be even less likely to be satisfied. Nearly all designs have been based on the assumption that the aircraft would be operating in reasonably civilized conditions and with the help of good ground organization, and only a few machines, produced in pre-war days, even partially fulfil the needs of operators in remoter areas.

Specialized types have been produced, for instance, in Canada for charter operations in parts where the only landing areas are stretches of water which, in winter, become ice, but nowhere else has a serious attempt been made to design an aircraft to suit "out-back" requirements. Yet it would seem that the market for a robust and somewhat old-fashioned aircraft built to modern ideas should be a quite unusually wide one if a satisfactory design compromise can be effected. In Australia there are dozens of small airline operators who would be more than interested, and this market alone might be worthy of investigation. The type required would be comparatively simple to manufacture and there would not, therefore, be any very serious gap between the finalization of the design and the start of production.

Conditions of Service

It is from Australia that we have received a specification suitable for mail and passenger-carrying among the cattle stations and mining fields in the Northern Territory and Northern Australia. Connellan Airways, the operators who have sent this specification, make a series of round trips from their base at Alice Springs, Central Australia, and the conditions do not demand an aircraft larger than that required to carry four or five passengers and a total disposable load of about 1,650 lb. Increases in operating frequency rather than of aircraft size are likely to be the only modifications to the services during the next few years.

More than sixty landings are already being made on each circuit, on strip airfields about 800 yards in length or even less. Geographical altitudes range up to more than 2,000ft, with density altitudes exceeding 5,000ft at air temperatures of more than 100 deg F. Low wing-loading and power-loading are, therefore, required, with a good rate of climb and engine-failure characteristics. Since landings are almost invariably made across-wind, a tricycle undercarriage and a reliable braking system are essential. The cruising speed would not need to be high—140 m.p.h. or so should be ample—but structural ruggedness and simplicity, as well as ease of maintenance, are obvious requirements

The specification, as submitted to us, is in some detail, but, though space does not permit more than an outline, any manufacturer who is interested may see the complete story. In brief, Connellan Airways recommend a high-wing monoplane with four under-slung and comparatively low-powered engines. C.85-12 Continentals of 85 h.p. are suggested (though the new Nuffield would fill the bill), these to be fitted with automatic V.P. airscrews. The conventional fuselage should be of welded-steel tube, fabric-covered, and the wing a cantilever structure of wood or metal. A fixed tricycle, with steerable nose-wheel, of the simplest possible kind should be fitted, with mechanical, servo or compressed-air braking; hydraulic operation is not recommended in hot-weather conditions. The flaps may be operated mechanically and should have a take-off position which appreciably shortens the run.

The total tank capacity of 118 gallons would be fully used or not to suit the loading and necessary range, the tanks being topped right up only when flying with a considerably reduced load. The normal fuel requirement would be 46 gallons. The tanks, two in each wing, should feed directly to the engines.

The seating arrangement would be for one passenger beside the pilot, with a three-passenger deck-chair type of seat immediately behind, and one seat aft, while provision should be made for stretcher-carrying, leaving space still available for the necessary doctor and nurse. Radio would be pilot-operated and installed in the wing. Freight and mail compartments should consist of one in the nose accommodating some 300 lb of comparatively heavy items and reached through a nose door, with a large compartment behind the passenger cabin for lighter freight up to the same maximum load, and allowing a possible increase to 500 lb when the fifth passenger seat is removed. There should be accommodation for emergency equipment, including spares, rations and water, with three doors for the passengers, a door for the rear freight compartment and the nose door. The gross weight of the entire aircraft should not exceed 4,300 lb.

As far as design is concerned, good lateral control at very low speeds is essential, because of the extremely gusty conditions experienced, with the maximum aerodynamic efficiency of the aircraft reached at low-power cruising conditions.

M.C.A. CONTROLLED

AT the moment, the following airfields are under the control of the Ministry of Civil Aviation: Aberdeen (Dyce), Aldermaston, Belfast (Sydenham), Benbecula, Blackpool (Squires Gate), Birmingham (Elmdon), Bovingdon, Bristol (Whitchurch), Campbeltown (Machrihanish), Cardiff (Pengam Moors), Carlisle (Kingstown), Croydon, Gatwick, Heston, Hurn, Inverness, Islay (Port Ellen), Kirkwall (Hatston), Liverpool, London Airport, Lympne, Northolt, Nottingham (Tollerton), Poole, Prestwick, Renfrew, Shoreham, Stornoway, Sumburgh, Tiree, Weston-super-Mare and Wick.

Others—presumably including Ringway, Manchester, and perhaps Eastleigh, Southampton—are still under consideration, and quite a large number of private and Service airfields are, in addition, available for use by civil aircraft. The complete list was given in *Notice to Airmen*, No. 146, and amended by Nos. 173, 182 and 184.

SKYMASTERS FOR CORPORATIONS?

IT is understood that B.O.A.C. and B.S.A.A., via the Ministry of Supply, are considering the purchase of a fleet of Canadian-built DC-4Ms for their North and South Atlantic services. The DC-4M is, of course, a Canadian-built version of the Skymaster powered with Rolls-Royce Merlin engines.

CONSTITUTION ON TEST

ON November 9th the prototype Lockheed Constitution made its first test flight from the company's base at Burbank, California, to Muroc Dry Lake, in the Californian Desert—where further tests with varying loads could be completed in comparative comfort and safety. The Constitution was originally ordered by the U.S. Navy as a high-speed transport, and there is no news, so far, of any serious orders for the type from the American airline operators.

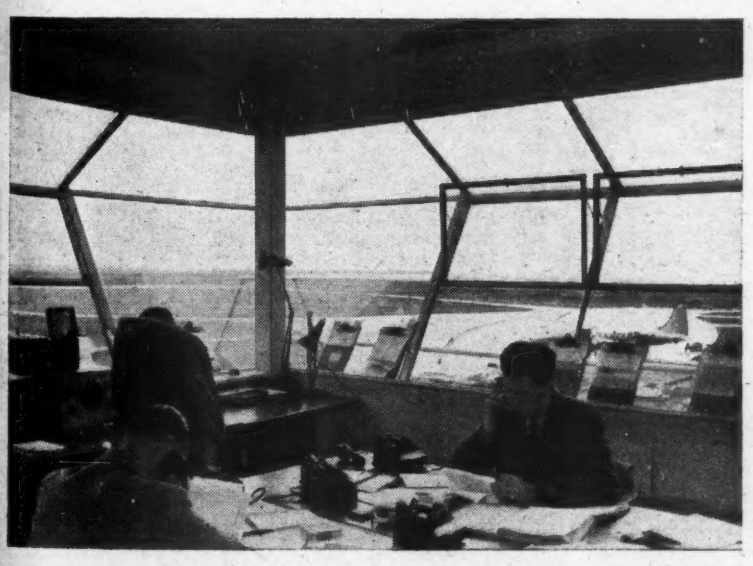
AEROVAN SUCCESSOR

TO be known as the Merchantman, Miles Aircraft are planning the production of a new charter type which is really a development of the basic Aerovan design. This aircraft, which is to be of all-metal construction, will be powered by four D.H. Gipsy engines and will have a payload of twice that of its predecessor. An initial order of some magnitude has, we understand, been placed by Air Contractors, Ltd., who will be the sole world distributors for the type.

G.C.A. FOR HEATHROW

WE understand from the Ministry of Civil Aviation that a Ground Controlled Approach system is to be installed at Heathrow. The decision has been taken, we are told, in view of the long period which must elapse before P.I.C.A.O. standardization can become effective, and of the desirability of avoiding the unnecessary cost to airline operators involved in the installation of special airborne equipment which may soon become obsolete.

Siting for the G.C.A. equipment is to start right away, but it is understood that operation will not be possible for several months. The first use to be made of the system will be that of "monitoring" all aircraft which are making instrument approaches by other means. In addition, of course, it offers a system of emergency blind-approach for all aircraft not fitted with any blind-approach equipment, and it will also be used to provide additional control information. Airfield Control Radar is also being installed, and this will show the controllers the exact patterns made by aircraft on the airways crossing the London area. At present, as we explained in last week's issue, there is no true traffic control and the knowledge of movements thus obtained should be extremely informative. Altogether, the decision, though a little late, is to be commended.



ATLANTIC CONTROL: Inside the airfield control room at Shannon Airport, Rineanna. Although the buildings at Rineanna are largely temporary, this airfield has become one of the busier and more important on this side of the Atlantic.

VIKINGS FOR AER LINGUS

VICKERS VIKINGS will shortly be used by Aer Lingus on their cross-Channel routes to augment their existing fleet of D.C.3s. Pending the purchase of new aircraft of this type, British European Airways are lending seven Vikings to Aer Lingus.

A nucleus of pilots and ground personnel, who have received training in England, will undertake the training of further flying and ground crews in Ireland.

U.S.–INDIA AGREEMENT

A BILATERAL air transport agreement between the United States and India was signed in New Delhi last week. According to Reuter, this agreement permits Pan American Airways to complete their Far East service with a link via Karachi, Delhi, Calcutta, and thence to points in Burma, Siam, Indo-China and beyond. Trans-World Airlines, who are also operating from the U.S. via Western Europe, North Africa and the Near East, will fly via Bombay, whence there will be two branches—one via Calcutta and another via Ceylon to Singapore. In return, the agreement allows Indian operators to run services to the U.S.

FOG DISPERSAL

A NUMBER of previously unmentioned historical and technical facts about Fido were given by Mr. A. C. Hartley, chief engineer of the Anglo-Iranian Oil Company, in a lecture before the Royal Society of Arts on November 13th. The way in which development work proceeded on the Fog Investigation Dispersal Operations since these were re-started in September, 1942, after they had been abandoned in 1939, was detailed by Mr. Hartley, who was technical director to the Fido team.

In spite of immense difficulties, both in the provision of a sufficient area of heat to dissipate the fog effectively and in the reduction of smoke, the first usable equipment was ready early in 1943 and initially tested by Air Vice-Marshal Bennett at Gravely. By the following autumn several stations were equipped and the system was in serious use. Two special problems arose at this time. One was that of providing a layout which could operate satisfactorily in a moving sea-fog at St. Eval—for the benefit of Coastal Command—and another that of equipping the three emergency airfields at Carnaby, Woodbridge and Manston. At these stations there were runways 3,000 yards long and 250 yards wide, but the system was suitably modified to deal with these special conditions—so successfully that, on one day in December, 1944, more than ninety aircraft, most of them Fortresses, were put down at Woodbridge in foggy conditions.

Meanwhile, work had been proceeding on more "permanent" designs, eliminating all obstructions and approaching as nearly as possible to press-button control. In later form, special burners were installed in cast-iron, grilled troughs, with automatic ignition control, and it was an improved form of this installation which was to have been used at Heathrow. With the final type of burner a much wider range of smokeless output was possible and the lecturer said that, should Fido be required, it would now be possible to use equipment of great flexibility, which could be "idled" indefinitely and which would show considerable economies. Amusingly enough, an area near Heathrow was one chosen for test purposes because of its liability to ground mist.

GATWICK AS A CHARTER BASE

FOR some time there have been speculations about the possible future arrangements for the accommodation of the dozens of charter operators now in existence. Many of them have been installed under conditions of considerable overcrowding at Croydon, and two or three others have made their base at White Waltham. The latter, however, though conveniently outside the London control zone, has no radio facilities, and it is necessary for the operators using this base to make Croydon

CIVIL AVIATION NEWS

a bad-weather "home-from-home." In the same way, one or two others have kept their aircraft and carried on necessary office work at other airfields, while using Croydon as an operating centre.

With the blessing of the Ministry of Civil Aviation, Gatwick has now been opened for the accommodation of charter operators and is being organized with traffic control, meteorological and radio facilities. Gatwick will, in fact, subject to the ever-recurring accommodation problem, be the officially sponsored airfield for the use of charter operators working in the London area, and we understand that some ten companies have arrived or are shortly moving in—though until the necessary redecoration of the terminal building has been completed before the new year, the situation even at Gatwick is likely to be difficult from the accommodation point of view. Apart from Airwork and Southern Aircraft, three companies—Bond Air Services, C.L. Air Surveys and Dennis Aviation—are already in occupation.

Although not quite of a size or type suitable for regular modern airline operation, Gatwick airfield, which was opened in 1936, has considerable advantages from the passengers' angle, and all the terminal facilities are provided. It is far enough from London to be outside the area of local bad visibility, yet, located as it is actually on the main London-Brighton line, it is within forty minutes' travelling time of the centre. That was one of the primary ideas when the airfield was first laid out, and fast trains are scheduled to stop at the airfield. Additionally, it is on the south side of London, a fact which makes it particularly suitable for Continental journeys. During the war Gatwick, which is still owned by Airports, Ltd., was extended to give maximum runs of 1,200 to 1,400 yards, and the grass surface is considered to be capable of dealing normally with aircraft up to an all-up weight of 25,000 lb.

BREVITIES

Mr. R. A. R. Wieland, who has for so long been traffic manager for Channel Islands Airways, has accepted the appointment of traffic superintendent of the English Division of B.E.A.C., with headquarters at Speke, Liverpool. Mr. W. L. G. Butt, who was previously in charge of the C.I.A. Guernsey station, will be taking over from him.

* * *

During the twelve months ending October 31st, the B.O.A.C. Bermuda-Baltimore service, operated with Boeing flying-boats, has carried over 12,000 passengers. A frequency of three schedules a week in each direction has been maintained without cancellation or delay.

* * *

A company with British, Chinese and Portuguese interests is expected to start four schedules a day on a service between Hong Kong, Canton and Macao. The flying time between Hong Kong and Canton is half an hour, and between Hong Kong and Macao some twelve minutes.

Mr. J. C. Trippe, president of P.A.W.A., has been awarded the Brazilian Order of the Southern Cross. The honour is conferred by the Government on non-nationals who have distinguished themselves in the maintenance, development and reinforcement of relationships between their countries and Brazil.

* * *

Orders for twenty-five four-engined aircraft are believed to have been cancelled by T.W.A. as a direct result of the strike of aircrew. Consequently, nearly 350 aircrew who were to fly these aircraft have been dismissed. That, at least, is one side of the story.

* * *

A secondary airport is to be built about twelve miles from Melbourne to relieve the congestion at the city's main airport. The Australian government has allocated £140,000 for the purchase of a site and construction of the airport—which hardly seems to be enough if the airfield is to be used for main-line traffic.

FROM THE FLYING CLUBS

NOW that the more active side of the Luton Flying Club has been thoroughly established, non-flying members are being encouraged, and the subscription has been reduced from £5 5s to £2 2s. They will, however, still pay the entrance fee which has been waived as far as flying members are concerned.

* * *

Three Proctors are now available for use by the Herts and Essex Club members at £5 10s an hour, dual and solo. The fleet now consists of six Tiger Moths, two Proctor Is, one Proctor V and one Hornet Moth. Arrangements have been made with the London School of Air Navigation whereby ex-Service pilots who are taking courses at the school can carry out any necessary flying at Broxbourne.

* * *

The "caretaker" committee which has been looking after the United Services Flying Club since its formation has now automatically resigned, and its place has been taken by a members' committee. Appropriately enough, the very first member, Mr. D. Copley, is the chairman, with the C.F.I., Mr. A. J. I. Temple-West, as secretary. As far as flying is concerned, the three Austers are now somewhat overworked and they will shortly be joined by a Piper Cub. A Tiger Moth is in the offing, and it is even possible that the Auster, originally acquired via the R.Ae.C., will one day fly again. The recently installed Link trainer is being kept busy.

* * *

After a comparatively humble start on June 9th with a single Moth Minor, the West London Aero Club now has seven aircraft—two Minors, two Austers, two Hornet Moths, and a Piper Cub. An additional Auster and Tiger Moth should be available shortly, while a further eight aircraft are waiting C. of A. overhaul. The three instructors also fly for the two affiliated clubs—the American Embassy Flying Club and the British European Airways Flying Club—on aircraft which are maintained by the West London Club. So far, forty-nine pupils have been trained *ab initio*. Remembering that White Waltham was, during the war, the headquarters of the A.T.A., it is not surprising that out of the total membership of 360 some 140 are ex-members of this organization. One of the growing activities of the club is the hangarage and maintenance of private owners' aircraft, some twenty of which are kept at White Waltham, which is conveniently outside the London control zone.

* * *

At Barton the Lancashire Aero Club has recently made a reduction in the cost of flying for those members who already hold "A" licences and have completed ten hours' flying; the rate is now £2 10s. The club was opened only on September 21st and, in spite of poor weather, has been doing very well; some twenty new pupils are under instruction and ten pre-war members have received their "A" licences.

* * *

The club, which was, in pre-war days, somewhat loosely known as the London Transport Flying Club, has now restarted flying on a reduced scale. With the assistance of Universal Air Training, two Tiger Moths have been obtained, even though, as the club had no airfield at the time, no Government aircraft allocation was received. The flying is now being done at Fair Oaks airfield, near Chobham, Surrey, and a large flight hut is being converted into a clubhouse, while a smaller hut is being requisitioned for use as a tea room and snack bar. It is intended, in fact, to provide many of the amenities of a country club in order to attract members who do not necessarily wish to fly. The instructor and manager is Flt. Lt. H. Baker, who obtained his "A" licence with the club in pre-war years and has since been a Service instructor.

During its long period of inactivity the club's interests were looked after by Mr. L. O. Wheeler, who has now been elected general secretary and treasurer. It is understood that the club is more than usually well set up financially, and that the flying rates are extremely low. No official opening ceremony has been organized, since it was thought better to postpone it until the spring, when more reliable weather conditions can be expected. As far as the name of the club is concerned, this is actually London Transport (Central Buses) Sports Association Flying Club. The Association was formed by members of the London General Omnibus Co., and since the L.P.T.B. merger it has retained its separate identity by the inclusion of the words "Central Buses" in the title—since it could not possibly cater for the whole of the organization.

PREPARING for the BRABAZON I

Points from a Paper by Mr. A. E. Russell, Chief Designer of the Bristol Aeroplane Company : Special Requirements : Power Control Possibilities

SOME idea of the very large amount of preliminary work involved in the development of really large aircraft was given by Mr. A. E. Russell in his Paper covering "Some Engineering Problems of Large Aircraft." As its title implies, a great deal of this Paper was devoted to direct production and structural problems, and we are dealing only with some of the points of more general interest.

Mr. Russell opened with a detailed reference to the special performance required from the Bristol 167. This is intended for the direct London-New York service, which, in addition to being one of the most important of the airline runs, is also one of the most difficult. The distance along a Great Circle course is 3,450 miles, but, since the prevailing winds are consistently unfavourable on the westbound crossing, very big allowances must be made. As a result, an actual still-air range of more than 5,500 miles was required of the aircraft. Consequently, the fuel and oil load formed the greatest percentage (37) of the all-up weight—greater even than that of the structure—while the weight of the passengers and luggage was a mere 8 per cent of the total of 300,000 lb.

In the particular case of an overnight non-stop service, the appropriate number of passengers could be accommodated in an orthodox single-deck circular body with provision for bunks, but it was interesting to examine the possibilities of an alternative solution. With available stopping places at Rineanna in Ireland and Gander in Newfoundland, the smaller weight of fuel required left more load available for a greater number of passengers and their accommodation.

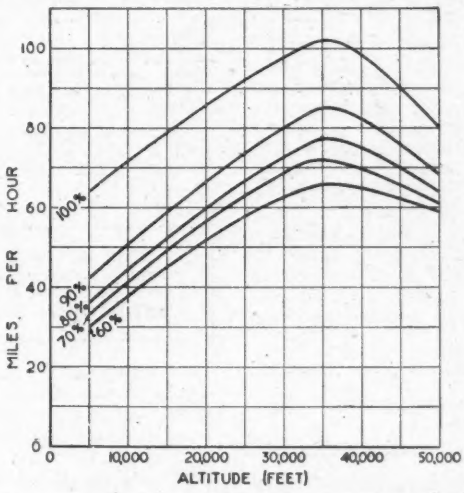
If a stop at Gander was scheduled, 76 per cent of the non-stop fuel was sufficient, and the reduced weight of fuel was equivalent to about 9 per cent of the all-up weight. If a stop was made also at Rineanna, then 66 per cent of the non-stop fuel was sufficient, with a saving equivalent to 12½ per cent.

It would appear then that a double-deck body of figure-eight cross-section could provide additional floor space for the accommodation of the extra payload. There were,

> *"During the winter months . . . when flying from London to New York . . . a headwind of 100 m.p.h must be catered for if 100 per cent regularity of operation, at 35,000ft, is required. . . ."*

however, two quite important effects arising from such a change. First, the weight of the body structure, floors, furnishings, pressurizing and other equipment was increased. Secondly, the wing structure-weight was greater, due to the increased bending movements resulting from the transfer of load from the tanks to the fuselage. In one particular case the sum of these two changes was estimated to be equivalent to about 6 per cent of the all-up weight. Thus, the actual payload was only increased from 8 to 11 per cent for the single stop, and from 8 to 13 per cent for the double stop. If special sleeping accommodation was not provided, the same number of passengers could be carried in the single-deck arrangement.

So the choice for the Atlantic appeared to be: (a) A single-deck body capable of doing the non-stop westbound crossing with sleeping accommodation for all passengers and with a payload amounting to about 8 per cent of the all-up weight, or seating accommodation for 50 per cent more passengers, probably on a stopping service. (b) A double-deck type unsuitable for the non-stop westbound crossing, but with sleeping accommodation appropriate to a passenger payload equivalent to 12 to 13 per cent of the all-up weight on the stopping service, and with considerably more seating capacity on alternative shorter runs.



Average effective wind experienced on the London-New York run during the winter months. Percentages give frequency of occasions when the effective headwind is less than the value given by the curves.

The conclusion reached was that for aircraft of about 300,000 lb all-up weight, a double-deck body was not the best arrangement if a range exceeding 4,000 miles was a primary requirement, and that a single-deck body gave greater flexibility for alternative passenger arrangements until conditions of operation across the Atlantic became established.

With such a small proportion of the all-up weight available for payload, it was more than usually important to achieve structural efficiency. Mr. Russell detailed the means used to study load vibrations and gust accelerations, the structural methods and materials used to provide the necessary strength, and the tests carried out on specimen sections. One of the more interesting means of alleviating the maximum loading stresses in the Brabazon I was mentioned later during a study of control forces and possible operating methods.

> *". . . as size increases . . . I believe that the uncertainty of over-balance or under-balance on the first flight alone demands the use of power operation for flying controls."*

The problem of providing completely satisfactory and properly co-ordinated flying controls had always been fairly difficult even on small aircraft. The larger the aircraft the more difficult it became, since beyond a certain point the pilot was incapable of exerting more effort. Thus, as size increased hinge moments had to come down, so tending to approach even more critical conditions. Although there had been exponents of aerodynamic balancing for the largest aircraft envisaged, Mr. Russell believed that the uncertainties in matters of over-balance or under-balance on the first flight alone demanded the use of power operation.

The main advantages of power-operation were as follows: (1) The power-control unit could be fully developed on the ground before the aircraft flew, thus eliminating the tiresome period of trial and error. (2) If an irreversible system was used, the weight of mass balancing saved was greater than

PREPARING FOR THE BRABAZON I

the weight added by the power units, and trim tabs could be eliminated. (3) Aerodynamic nose-balance could be eliminated with the advantages of a saving in weight, a simpler construction of flap and associated aerofoil, and a more rearward position of the rear spar, giving more space for the torsion box and for inter-spar fuel stowage. (4) Artificial "feel" could be adjusted to any desired values. (5) Electrical controls between the pilot and surfaces were simpler and lighter to install than mechanical controls. (6) The ailerons could be operated automatically to relieve any loads caused by severe gusts.

The objections to the use of power were based entirely on the question of reliability. Any power system was inevitably more fallible than manual operation in that it introduced fairly complex mechanisms. Since the safety of the aircraft depended on satisfactory operation, many felt that a powered system should be designed so that, in the event of a failure, an emergency manual system could save the worst catastrophe. Much sympathy was felt for this point of view, but so many advantages were lost that serious consideration had to be given to the alternative solution of providing complete duplication.

In this case each control flap would be operated by two completely independent units, each deriving its power from separate engines and through separate transmission systems. Each of the units should be adequate for the full control loads, though possibly at a reduced rate of operation, while, in the event of the failure of one unit, it should be automatically decoupled, leaving the second unit in sole operation.

> *"The payload is . . . inevitably a small proportion of the take-off weight."*

The most favourable conditions were fulfilled if the power-control mechanism were installed as a complete unit, leaving only the minimum number of electrical or mechanical connections to be made *in situ*. This permitted thorough testing and checking before installation. In the event of a defect developing in service, a proper examination of the nature and cause of the defect could be made. Power units should not be serviced *in situ*, but only on the bench with the aid of any special equipment needed for a complete examination.

Needless to say, the development of power control units should be thorough and exhaustive, covering all possible conditions of atmospheric changes and structural distortions.

Mr. Russell put forward the following characteristics as "operational targets" for power-operated controls:—

(1) The link between the pilot's controls and the control flap (i.e., the transmission and the servo system) should be such that the pilot's control and the flap should be tied to within 1 deg., this lost motion being enough to operate the servo. (2) Reversal of pilot's effort must produce an immediate control response; this was essential for precise trimming. (3) The load on the pilot's control should be produced artificially, e.g., by a spring; it must be at zero for the trimmed position and increase uniformly on each side of trim so that when the control was released from a deflected position control and flap returned to the trimmed position. (4) The maximum value of the pilot's effort should be 20-40lb for ailerons, 40-80lb for elevators, and 80-160lb for rudders. (5) Friction loads should be less than 1/20th of the maximum loads. (6) The "feel" loads should not be affected by rates of operation. (7) It was probably desirable that the maximum pilot's force should correspond to maximum power-loads, i.e., proportional to speed squared as well as deflection. (8) The maximum rate of flap operation should be about 30 deg. per second; this rate was most likely to be used in landing conditions since, with the slow response of a large aircraft, there was no point in exceeding this value unless the ailerons were used to relieve gust loads.

The servo unit would be effectively irreversible and both units in each control should be in action together so that, in the event of failure of one, irreversibility would be maintained.

> *"Power operation of the ailerons makes it possible for them to be operated symmetrically for gust relief. Thus, when the aircraft enters an up-gust, if both ailerons are deflected upwards the loads . . . are considerably reduced."*

At high cruising speeds gust conditions produced very severe stresses in the wings, and the additional structural weight required to combat the severest gust might be equal to four per cent of the all-up weight. Power operation of ailerons made it possible for these to be operated symmetrically to relieve gust loadings. Both ailerons would thus be deflected upwards to an amount proportional to the intensity of the gust. Since the action would need to be almost instantaneous it would be necessary for this to be arranged automatically and at a displacement rate twice that used in normal operation. The gust could be detected by a pitch meter, which could cause the aileron servo to operate to a degree proportional to the intensity.

Mr. Russell then described briefly the various types of power-servo units which might be used. Since all these would, in basis, be electrically operated, he ended his Paper with a critical survey of the general features of modern electrical installations. By careful attention to layout and by providing duplication where necessary, he thought it should be possible to comply always with the essential requirement which was that "*any* type of fault in *any* part of the system should not result in loss of power supply to vital components."

RADIO DEFENCE PROBLEMS

A NEW danger in any future war was mentioned in the course of a lecture given by Air Vice-Marshal E. B. Addison, C.B., C.B.E., A.-O.-C., No. 90 (Signals) Group, R.A.F., in London, on November 13th.

Speaking on "The Radio War" to members of the Royal United Services Institution, Air Vice-Marshal Addison said there was a likely danger now the war was over that scientific effort might be wholly directed to the production of bigger and better weapons and so leaving none available for the equally important task of inventing methods of stopping them.

It was the most important lesson that the radio war had to teach. It might well be, he said, "that these new weapons would require some form or other of radio control, not only to guide them to their objective, but finally to explode them at the desired moment.

"If such is the case," he said, "it should not be beyond the ingenuity of the radio scientist and engineer to devise means of diverting these projectiles or of causing them to explode before their due time.

"Scientists, too," he went on, "must find a way of detecting and following their course at whatever height or at whatever speed they travel, and then possibly of firing another projectile capable of being directed unerringly towards the intruder to meet it in mid-air."

In Air Vice-Marshal Addison's opinion, the effects of any product of the scientist's brain are always capable of being neutralized by a fellow-scientist working in the laboratory next door, and, if there should ever be another conflict, this might be the deciding factor.

"Success in any future war between fully developed nations," he concluded, "may well turn on the fulfilment of this theory. The principles of radio warfare learned and applied for the first time in the last war, will require to be continuously studied and exercised in order that we may profit by them in the next."

Air Marshal Sir James Robb, K.B.E., C.B., D.S.O., D.F.C., A.F.C., Air Officer Commanding-in-Chief, Fighter Command, presided.

CORRESPONDENCE

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

AUXILIARY AIR FORCE

East Anglia is Again Neglected

RECENTLY I was full of enthusiasm when reading of recruitment for the A.A.F., but it has been somewhat damped by the list appearing in your November 7th issue. The squadrons are practically the same as pre-war, and, as before, Norfolk, Suffolk and surrounding districts are completely neglected, whilst Yorkshire has three Squadrons.

One would think the A.M. could find room for a "City of Norwich" Squadron to serve this area; the A.T.C. and R.A.F.A. are strong and enthusiastic in this district and there are many ex-R.A.F. officers and men who would welcome such an opportunity.

EX-FLT. LT., AIRCREW.

"YOU CAN'T GO WRONG"

Avoiding Confusion in the Cockpit

ONCE again an American "invention" is being given publicity when we poor Britons thought of the idea long ago.

I refer to your account, in "Here and There" (*Flight*, October 31st), of the new shapes and positions for control levers in American naval aircraft. Unless my memory is failing, I can remember using "undercart," "flap" and "bomb-door" levers, which were shaped like the components they operated, on a Fairey Battle as long ago as 1940. More widely remembered probably is the "Oxford," which also had specially shaped "flap" and "undercart" levers.

In my opinion, the best method was that which was used on the Beaufighter, in which the undercarriage could not be raised, whilst the weight of the aircraft was on the wheels, without first moving a second lever.

ANTONY C. POWNER, Ex-Flt. Lt.

[The levers in the Battle were no doubt shaped differently to avoid confusion, but, so far as we are aware, no British aircraft has yet employed the feature of "replica" shapes for the different controls.—ED.]

WHY "CENTRIFUGAL FORCE"

Slack Methods That Cause Confusion

THE suggestions made by "S. W. G." (*Flight*, October 24th) on the use of abbreviations are quite good, as the method does tend to bring to mind the differences in units which may be the same numerically.

Most of the trouble arises from the fact that whilst a physical entity cannot have more than one dimensional value, one dimensional expression may stand for more than one physical entity.

The abbreviation "lb" is often used when what is meant is "lb-wt," and one suggestion that has been made is to use the word "pound" when the pound mass is being referred to, and the abbreviation "lb-wt" when force or weight is being considered. Confusion is increased by such slack methods as stating pressure in "pounds," instead of "pounds per sq inch."

Recent correspondence in *The Engineer* shows that keen interest is being taken in the question of abbreviations to aid clarity of expression, and the whole matter requires to be put on a proper footing by some authoritative body, say, the B.S.I.

G. D. DUGUID
(Senior Master, The College of Aeronautical Engineering).

The Slug as a Unit of Mass

YOUR correspondent "S. W. G." (*Flight*, October 24th) appears to forget, in his haste to put forward a new nomenclature for units of force, that another and more convenient method has been employed by engineers and aerodynamicists for many years.

I refer, of course, to Professor Perry's unit of mass, the Slug, which, probably on account of its unfortunate name, has never received the acceptance which it deserves; its great advantage is that, when making the majority of calculations connected with the motion of bodies, there is no need for the introduction of the gravitational acceleration. Many students will no doubt agree with me that, in the heat of examinations (and even in more leisurely moments), there is a great tendency to forget "where to put the g," and I feel that any simplification in this matter should be used as much as possible.

Lest "S. W. G." should think that the Slug is so called on account of the habits of a common mollusc, I should point out that a slug may also be a piece of metal, which quite easily could have a mass of 32.2 lb and was chosen by Prof. Perry on this account.

E. T. B. S.

ANOTHER IMPOSTOR

"Supersonic" is Also an Offender

FOLLOWING Mr. Duguid's recent exposure of the impostor "Centrifugal Force" (*Flight*, October 10th)—I venture to draw attention to a certain duplicity which, I feel, another term has assumed in recent years. The offending term is the word "supersonic," and here is my argument against the second meaning which, by common usage, it now carries.

Sound, basically, is a sensation which can only occur in the brain. The meaning of the word is, however, extended to include (1) the vibrations in the atmosphere or other medium which transmits the necessary stimulus to the ear, and (2) the events which cause such vibrations to occur. But only those events or vibrations which can ultimately give rise to the sensation of sound are included in the definition. Many vibrations which arrive at the ear have frequencies so high that the translating mechanism of the air cannot respond to them and no sensation is produced; therefore they are not sounds but supersonic vibrations. Here the word "supersonic" has its original meaning and implies a comparison with the upper limit of the human faculty of hearing.

Now the faculty of hearing is concerned with the frequencies of vibrations but is not concerned with their speeds of propagation. In other words, *sound* is independent of its speed of propagation. Similarly, supersonic vibrations remain supersonic regardless of their speed of propagation.

In recent years, with the development of interest in high-speed flight and high-speed movement of gases, the word "supersonic" has been used to describe (a) speeds of aircraft or of projectiles which exceed the speed of propagation of waves in the air through which they move, and (b) speeds of gases which exceed the speed of propagation of waves within the gases. These events are entirely independent of the human faculty of hearing and therefore it seems to me inadequate to describe them by a word which has previously been inseparable from this same very limited human faculty.

In point of fact, the events are related only to certain elastic properties of the gases, and it would therefore seem more reasonable to use terms which have a bearing on this fact and which exclude any connection with the human sense of hearing.

The obvious choice of new terms would seem to be

"wave speed" instead of "speed of sound,"
"sub-wave speed" instead of "subsonic speed,"
"super-wave speed" instead of "supersonic speed."

The proposed new terms, though less mysterious and, consequently less glamorous than those already in use, seem to me to be more descriptive and more accurate. I should be interested to know what other readers think.

C. ARMER.

AIR CRASHES

Helicopters as Rescue Craft

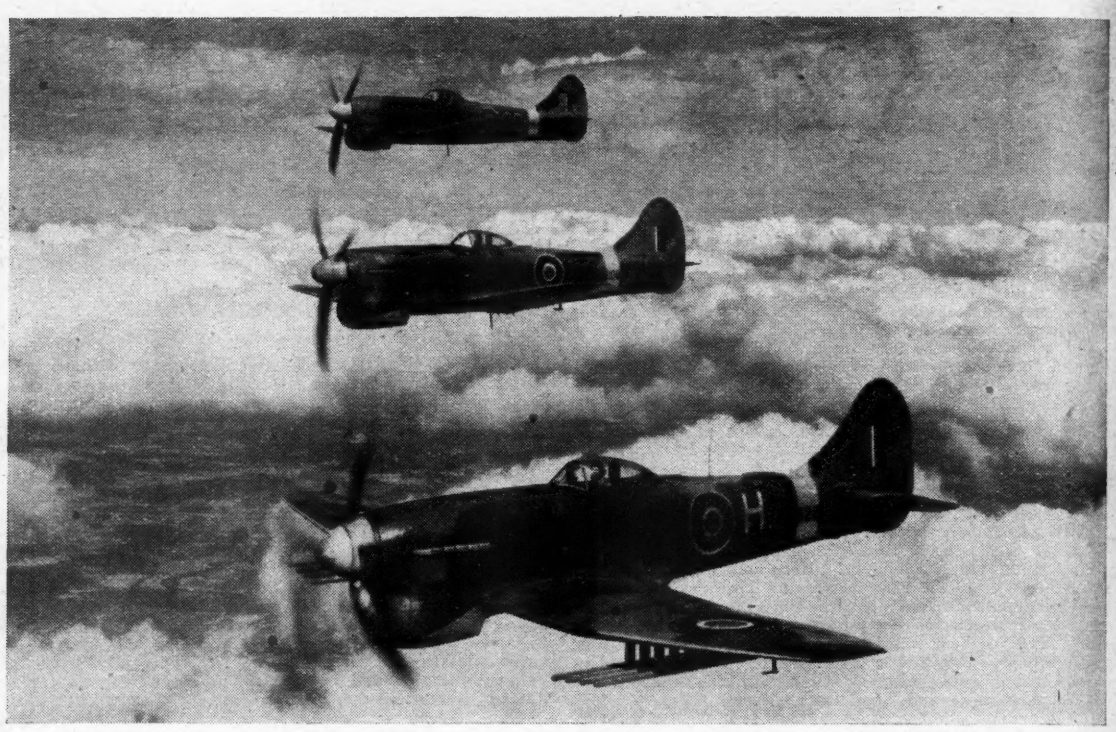
I AM just reading "474's" letter (*Flight*, October 31st) in which he suggests that helicopters would be used to rescue the victims of air crashes.

This idea has already been successfully tried by the U.S.A.A.F. to rescue the survivors of the "Sabena" DC-4 which crashed near Gander last September.

A rescue party dropped by parachute realized that the wounded could not be evacuated by land, owing to the gravity of their wounds. Then the U.S. Army Air Force shipped two helicopters to Newfoundland. These helicopters, carried in a giant transport plane, were assembled at Gander airport and ferried the wounded to a lake where they were taken by amphibian.

A BELGIAN READER.

[Our Belgian reader has rather missed the essential point of "474's" letter, which was that helicopters should be kept *standing by in readiness* at airports in the same way as are motor ambulances and fire tenders.—ED.]



STRAFERS: Hawker Tempest V single-seat fighter and close-support aircraft (Napier Sabre), the nearest with R/P. rails and the other pair with bomb carriers. Tempest II, V and VI aircraft are now standard equipment in many R.A.F. squadrons.

SERVICE AVIATION

Royal Air Force and Naval Aviation News and Announcements

R.A.F. Wants Trained Men

AIR CHIEF MARSHAL SIR PHILIP JOUBERT, Director of Public Relations, Air Ministry, recently appealed to trained men of the R.A.F. to extend their service or to return to the R.A.F. from civilian life. He explained the position in these words:

"I am perfectly happy for the future four years hence, because we are getting a reasonable number of volunteers straight from civil life. In the immediate future, however, we are desperately short of trained men because between 1939 and 1945 there was a complete gap in the recruitment of Regulars. We want the 'old sweats' back and we want them badly. We must convince the young cynics in the Air Force who are aggravated by the fact that they are still living under war conditions, although we have been at peace for more than a year, that conditions will improve as soon as civilian difficulties, such as the housing shortage, are put right."

Badge of No. 2 (Army Co-operation) Squadron, R.A.F. Motto: Hereward.

Badge of No. 207 Air/Sea Rescue Unit, R.A.F. Motto: Ex Mari Servamus.

Naval Aviation Appointment

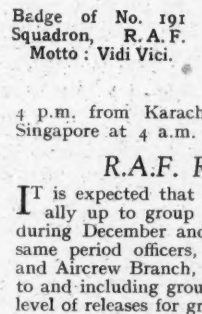
THE Admiralty has announced the appointment of Vice-Admiral Sir Cecil H. J. Harcourt to be Vice-Admiral (Air) and Second in Command of the Mediterranean Fleet. His new duties will date from January 7th next year.

Vice-Admiral Harcourt took part in the North African and Salerno landings and was later in command of a carrier squadron attached to the British Pacific Fleet.

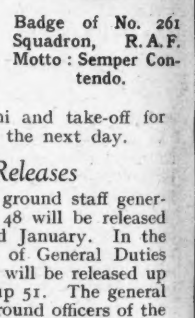
On September 16th, 1945, he accepted the Japanese surrender of Hong Kong and remained as Commander-in-Chief.

New Transport Command Route

IT was announced at Colombo on Thursday last that R.A.F. Transport Command had inaugurated a new route from Britain to Singapore, by way of Ceylon instead of Calcutta. A daily service of Avro Yorks has been in operation since November 8th. The aircraft arrive at Negombo airfield, Ceylon, at 4 p.m. from Karachi and take-off for Singapore at 4 a.m. the next day.



Badge of No. 191 Squadron, R.A.F. Motto: Vidi Vici.



Badge of No. 261 Squadron, R.A.F. Motto: Semper Contendo.

R.A.F. Releases

IT is expected that ground staff generally up to group 48 will be released during December and January. In the same period officers, of General Duties and Aircrew Branch, will be released up to and including group 51. The general level of releases for ground officers of the R.A.F. will be group 48, and for W.A.A.F. officers group 52; with the exception of some trades, airwomen will also reach group 52. Redundant air-

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crew will be released at the rate appropriate to their former aircrew category or of the trade to which they have remustered, whichever is the more favourable. Some unavoidable variations between the groups will inevitably remain.

Nene-Vampires for R.A.F. and R.A.A.F.

TWO de Havilland Vampire fighters powered by Rolls-Royce Nene turbine-jet units are now flying on development tests and it is announced that large numbers of Nene-Vampires have been ordered for the R.A.F. Australia also plans to produce them. Not only is the rate of climb of the Nene-Vampire considerably better than that of the well-known Goblin-powered version, but speed and take-off are improved. Range at 30,000ft remains the same.

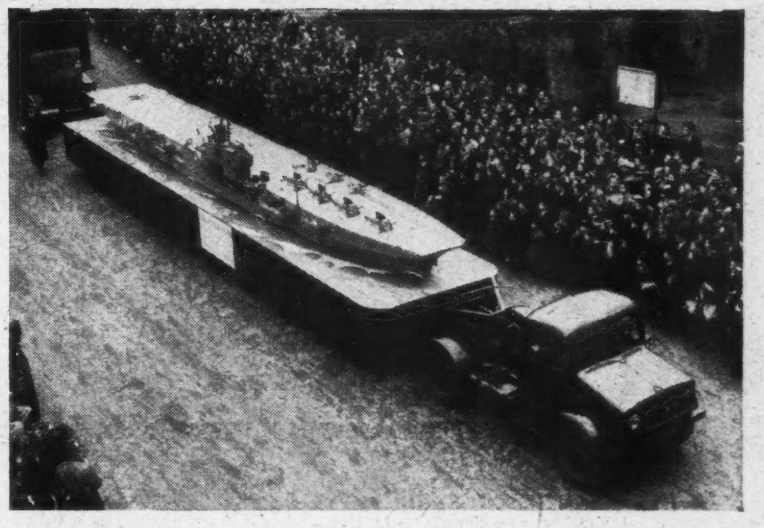
R.A.F. and Adult Education

INSPECTORS from the Ministry of Education have been visiting R.A.F. Education Centres to study the Educational and Vocational Training Scheme, which, since shortly after V.E. Day, has been helping to prepare men and women for their return to civil life.

Three teams, each of six inspectors, recently made a three months' tour of E.V.T. centres for the R.A.F. in the Middle East, Italy and Germany and inspectors in the United Kingdom visited the E.V.T. centres of the Royal Air Force at home.

The E.V.T. scheme covers three classes of training—resettlement training in citizenship, educational courses at various levels, and vocational instruction in certain civilian occupations. At its peak about 9,000 instructors were employed, and the methods used included films, lectures, discussion groups, planned courses of study, text books and training for a civilian occupation in R.A.F. workshops or with civilian firms.

It is hoped that these visits will be of mutual benefit to both departments and will assist towards the co-ordination of adult education over the whole field.



CARRIER-BORNE CARRIER: A splendid model of H.M.S. *Triumph* complete with Fireflies, Seafires and a Sea Vampire, was a novel addition to the pageantry of the Lord Mayor's Show.

History of D.A.F.

A HISTORY of Desert Air Force achievements in the Western Desert, Sicily and Italy is being compiled by F/O. Roderic Owen, formerly a Flying Control Officer with D.A.F.

In Italy in 1945 Air Vice-Marshal R. M. Foster, C.B., C.B.E., D.F.C., the A.O.C., D.A.F., decided that the Force deserved its own history and entrusted F/O. Owen with the task of writing it. The author has access to many documents from enemy sources and intends to contrast the Allied and Axis air organizations in the three theatres of war.

Seven hundred officers and men of D.A.F. subscribed to the book, which will be published by Hutchinson next summer. It will also be available to the public. All royalties from sales, including an advance of £500, will go to the R.A.F. Benevolent Fund.

V.I.P. AT UPPER HEYFORD: General de Lattre de Tassigny, Chief of Staff of the French Army, at the Parachutist Training School, Upper Heyford, near Oxford, on November 8.

Belgians Leave R.A.F.

THE transfer of the Belgian Section of the R.A.F.V.R. to the newly re-created Belgian Air Force was reported in *Flight*, November 7th. Now comes news that at Fassberg mechanics have been painting out the R.A.F. roundels on two squadrons of Spitfires and substituting the red, gold and black insignia of the Belgian Air Force.

The oldest of the completely Belgian units to operate with the R.A.F., No. 349 Squadron, was formed in November, 1941, at Valley, in Anglesey, and can probably claim a record for long service with Spitfires, commencing with the old Mark II, through IV, Vb, IX, XIV, XIVb, to the XVI with which they are now equipped.

The other squadron, No. 350, was formed later but had an equally distinguished career, including beachhead patrols for the Normandy landings, operations against flying bombs and air cover for the Ardennes offensive. During the height of the flying bomb "season" the squadrons formed a part of a Wing commanded by Group Capt. "Johnny" Johnson which claimed 90 destroyed in three months.

Throughout its history, 349 Squadron has had a long line of well-known pilots as Commanding Officers, including such as Sqn. Ldr. Harry Walmsley, D.F.C. and Bar, Terry Spencer, D.F.C., and Wing Cdr. Don Kingaby, who led them at the time of the Normandy invasion. Towards the end of the war the policy of appointing a British officer as C.O. was discontinued and, apart from R.A.F. engineering officers and N.C.O.s, the unit was completely Belgian.

Four of the engineering staff have

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been asked to move to Belgium and carry on their valuable liaison work.

Present leaders of the two squadrons are Sqn. Ldr. Van de Velde, D.F.C., who flew for more than three years with English fighter squadrons, and Sqn. Ldr. Van Leide, D.F.C. and two Bars, generally considered one of the most successful Belgian pilots. He is credited with having shot down 39 flying bombs and several German aircraft.

Three hundred and fifty pilots escaped from Belgium soon after its occupation and came to England to serve with the R.A.F. Of these 208 died in action and some have gone into tivil aviation.

Death of Naval Flying Pioneer

REAR-ADMIRAL COSMO MORAY GRAHAM, C.B., died at Wadhurst, Sussex, on November 7th. He was 59. Rear-Admiral Graham was Director of the Naval Air Division from 1937 to 1939, and was one of the principal Admiralty representatives in the transfer of the Fleet Air Arm from the Air Ministry. He received his C.B. in 1942.

No. 210 Squadron Reunion Dinner

A REUNION dinner for 210 Squadron R.A.F. is being held in London on January 15th, 1947. All wishing to attend should communicate with the Honorary Secretary, Squadron Leader C. M. Owen, Lauvergne, Burston Drive, Park Street, near St. Albans, Herts, as soon as possible.

Helicopter Training

IT has been decided to issue the small number of Hoverfly Mk. I (Sikorsky R.4) helicopters now in the country to a training Flight at the Ministry of Supply Airborne Forces Experimental Establishment at Beaulieu, Hants. This Flight should be proficient in handling these aircraft in three to four months, after which it will receive Hoverfly Mk. IIs (Sikorsky R.6s) and return to its parent station at Andover to begin tactical trials at the direction of the Air Ministry and War Office. Two other Hoverflies will be delivered to the Air/Sea Warfare Development Unit for investigation of their usefulness for rescue work.

UP WITH THE RATIONS: A Halifax delivers a stick of supply containers during a recent demonstration before the School of Air Support. The last Halifax has now been delivered to the R.A.F.

British Airmen Reburied

THE bodies of sixteen British aircrew, killed in crashes while operating during the Warsaw rising, have been exhumed from graves in and around the city and have been reburied in the Polish Military Cemetery in Warsaw. Polish infantry provided a guard of honour and fired a salute. Group Capt. Burt-Andrews, British Air Attaché, was present.

On November 11th seventy Allied airmen were reburied in the Allied War Cemetery in Berlin. Officers from R.A.F. Station, Gatow, attended, headed by Air Vice-Marshal A. P. Davidson. Two buglers of the Grenadier Guards sounded Last Post.

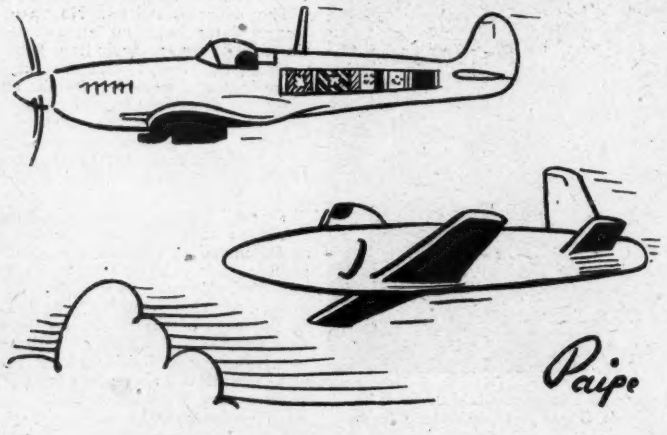
Air Armament Pioneer

IN the recent death, in a flying accident in Germany, of Air Commodore E. D. M. Hopkins we have lost the real pioneer of modern aircraft gunnery testing. A colleague writes:

"As an Armament Officer who had already displayed a particular aptitude for experimental work, 'Hoppy' served at the A. & A.E.E., Martlesham Heath, in the capacity of Experimental Gunnery Officer during the critical years 1933-1937 and later commanded the Armament Testing Squadron. For the greater part of this period he carried, alone, an enormous responsibility for the Service acceptance testing of all R.A.F. gunnery installations, the weapons themselves and associated equipment. In the later stages of his tour at the A. & A.E.E., developments, which were subsequently to prove of vital importance, were taking place in fighter and bomber gun armament. Three of the better known were the 0.303in Browning gun, wing-gun installations in the Hurricane and Spitfire, and power-operated gun turrets. In those times, almost every gunnery trial presented a new problem. Thus it happened that 'Hoppy,' by his own patient and intelligent investigation, had to build up his own testing methods.

"The ideals for which he strove are the foundation upon which the technique of gunnery testing for the R.A.F. has been based. The principles which he formulated have been handed down through succeeding generations of Experimental Gunnery Officers at the A. & A.E.E. and, in spite of the rapid progress of war, experience has proved them to have been amazingly right.

"'Hoppy' never made the mistake of trying to solve problems by theorising. How fortunate it was that, when quite a large school of thought was insistent that 'manœuvring combat is impossible at 300 m.p.h.' he quietly proceeded to make quite certain that fighter aircraft's guns would start to fire and continue firing during every possible type of combat manœuvre. He was an exceedingly able pilot and himself undertook a large proportion of the gunnery testing in the air of a wide variety of prototype and experimental aircraft. Similarly, in the pre-turret era he did an enormous amount of firing as an air gunner. To demonstrate his belief in the power-operated turret, he frequently subjected himself to long periods of exposure and great discomfort at high speeds and altitudes in open gun positions in order to prove that accurate shooting was impossible under such conditions."



What did you do in the great war, daddy?